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ENGINEERING DESIGN FILE

SUBCONTRACT NO. SOO-588051

PROJECT FILE NO. 020978

OU 3-13 Group 1 Tank Farm Interim Action Phase 1 and 2

DRAINAGE DITCH CAPACITY VERIFICATION AT INTEC



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ENGINEERING DESIGN FILE

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PROJECT/TASK OU 3-13 Group 1 - Tank Farm Interim Action Phase 1 & 2

SUBTASK Ditch Sizing

EDFPAGENO. 1 OF 26

TITLE DRAINAGE DITCH CAPACITY VERIFICATION AT INTEC

SUMMARY

The Waste Area Group 3, Operable Unit 3-13 Record of Decision (ROD) for the Group 1 - Tank Farm Interim Action requires installation of engineering controls to reduce water infiltrating into the contaminated tank farm soils. This Interim Action includes upgrading the existing storm water runoff collection system in the tank farm including a 150-ft drainage control zone around the tank farm and constructing a lined evaporation pond where storm water runoff from the INTEC facility will be collected. The ROD requires the storm water collection system to accommodate a 25-year 24-hour storm event.

This EDF summary is for the design of the concrete lined ditches and culverts to be located throughout the northeast portion of INTEC. The components of the system were sized to carry the peak discharge from a 25-yr storm event. Table 3 shows a summary of each component's design flow versus its respective capacity. Attached to this EDF are worksheets and figures used for sizing of the individual components.

Assumptions:

1. Design capacity for the drainage subarea is calculated for the downstream end of the area and applied over the entire length of the drainage path.
2. The Rational Method was used for calculation/sizing of the ditches and culverts. In using the Rational Method, the maximum rainfall intensity for a design year storm is determined by the time of concentration for the drainage area. Thus, it represents the instantaneous peak for that area regardless of the duration of the storm event. As a result, sizing derived by the Rational Method will suffice for the 25-year 24-hour storm event as well as the 25-yr 6-hr storm.
3. The rainfall intensity, i , is constant over the storm duration.
4. The rainfall is uniformly distributed over the watershed.
5. The maximum rate of runoff will occur when runoff is being contributed to the outlet from the entire watershed.
6. The peak rate of runoff equals some fraction of the rainfall intensity.
7. The watershed system is linear.

QUALITY LEVEL 1 2 3

KEYWORDS (e.g. area, structure no., general subject matter, etc.) : Lift Station, Force Main, Olive Avenue, Storm Water

AUTHOR



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BBWI Review	DATE	BBWI Review	DATE

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PROJECT/TASK OU 3-13 Group 1- Tank Farm Interim Action Phase 1 & 2

SUBTASK Ditch Sizing

EDFPAGENO. 2 OF 26

SUMMARY (Continued)

References:

1. DOE-ID, *Final Record of Decision for the Idaho Nuclear Technology and Engineering Center, OU3-13 at the Idaho National Engineering Laboratory*, USDOE-ID, USEPA, IDHW, DOE-ID-10660, October, 1999.
2. Highway Drainage Guidelines, Storm Drainage Systems, Dan Ghere et al., 1987
3. SCS, Urban Hydrology for Small Watersheds, Soil Conservation Service, Technical Release- 55, June, 1986.
4. Hydrologic Analysis and Design, Richard H. McCuen, Prentice Hall, Englewood Cliffs, New Jersey, 1989.
5. Field Survey
6. Flowmaster Engineering Software, Version 5.13, Haestad Methods, Inc., 37 Brookside Road, Waterbury, CT, 1995.
7. Vendor Data Catalog, ACO Trench Drains Systems Manual.
8. Handbook of Steel Drainage & Highway Construction Products, American Iron and Steel Institute, Fourth Edition, 1993.

Table 1 - Design Flow

Alignment (1)	From (2)	To (2)	Component (3)	T _{cs} (min)	T _{tr} (min)	T _c (min)	I (in/hr)	A (acre) (4)	CA (5)	Q from LS (cfs) (6)	Q _T (cfs) (6)
Alignment 1	A2	LS	Trench Drain	20	-	20	1.5	2.75	1.81		2.72
Alignment 2	C5	C4	Conc. Ditch	19	-	19	1.6	2.43	1.97	2.72	5.88
	C4	C3	Conc. Ditch	17	0.8	19.8	1.52	3.80	3.20	2.72	7.59
	C3	C2	Conc. Ditch	16	1.14	20.94	1.5	4.52	3.51	2.72	7.98
	C2	C1	Conc. Ditch	16	0.6	21.54	1.47	5.31	3.87	2.72	8.41
	C1	B1	35"x24" CMPA	-	-	-	-	-	-	-	8.41
Alignment 3	C6	C5	Conc. Ditch	17	-	17	1.7	0.73	0.55		0.93
Alignment 4	A1	A2	Type I Conc. Ditch	15	-	15	1.8	0.51	0.46		0.82
	A2	A4	Conc. Ditch	17	1.39	17	1.7	1.86	1.47		2.49
	A4	A5	Conc. Ditch	18	1.2	18.2	1.65	3.59	2.90		4.79
	A5	A6	Type III Conc. Ditch	15	1	19.2	1.59	8.08	5.66		9.00
	A7	A8	Type III Conc. Ditch	15	0.62	19.82	1.52	10.80	7.96		12.09
	A8	A9	Type III Conc. Ditch	20	0.5	20.32	1.49	13.49	8.92		13.30
	A9	A10	Type III Conc. Ditch	20	2.4	22.22	1.4	15.54	9.91		13.87
	A10	D2	Existing Culvert	40	-	40	1	60.00	30.00		30.00
Alignment 5	C7	C4A	Type 1 Conc Ditch	15	-	15	1.8	0.69	0.62	-	1.12
Alignment 6	A4A	A4	Type I Conc. Ditch	16	-	16	1.72	0.89	0.80		1.37
	B6	B4	Conc. Ditch	17	-	17	1.7	1.04	0.91		1.54
	B4	A7	Conc. Ditch	17	1.48	18.48	1.65	2.12	1.84		3.04
Alignment 7	B6	B4	Conc. Ditch	15	-	15	1.8	0.69	0.60		1.08
Alignment 8	B2	B1	Existing Culvert/Type 3	20	-	20	1.5	2.35	2.04		3.07
	B1	D1	Type 3 Ditch	10	22.29	22.29	1.4	8.10	6.07	2.72	11.21
	D1	D2	Existing Modified Culvert	-	-	-	-	-	-	-	11.21
	D2	D3	Existing Culverts	-	-	-	-	-	-	-	43.94
	D3	D4	Existing/New Culvert	30	-	30	1.1	16.69	10.51	-	55.50

Definitions:

- T_{cs}** Time of concentration to develop subarea (includes initial lag time), Figure III (from ref. 2) pg. 23 of 23 and reference 4
T_{tr} Travel time through subarea, see Table 3
T_c Time of concentration
I Rainfall intensity, from Figures 1 and 1-A (ref. 2) pgs 21 and 22 of 23
A Catchment area
CA Weighted runoff coefficient * catchment area
Q_T Total design flow

- (1) See pg. 11 and 12 of 23 for alignment designations.
 (2) See pg. 10 of 23 for drainage area node/concentration point locations.
 (3) See respective alignment profile for complete component information.
 (4) See pg. 10 of 23 for catchment areas.
 (5) See Table 2 for runoff coefficient information.
 (6) See Table 3 for Design flow and component capacity.

Equations:

$$T_c = 0.0078L^{0.77}S^{-0.385}, \text{ see ref. 2 and Figure III pg. 23 of 23}$$

where: L = length of channel/ditch from headwater to outlet, ft
 S = average watershed slope, ft/ft

Q = CIA Rational Method

Table 2 - Runoff Coefficient

Sub-Area	Total Area ft ²	Area Acres	Impervious ft ²	Acres	Pervious ft ²	Acres	Cimp	Cp	Cwt	CA
Alignment 81										
A2 to LS										
B	70964	1.63	35482	0.81	35482	0.81	0.9	0.3	0.6	0.98
D	48611	1.12	36458.25	0.84	12152.75	0.28	0.9	0.3	0.75	0.84
	119175	2.75	71940.25	1.65	47634.75	1.09				1.81
Alignment #2										
C5 to C4										
C	31818	0.73	23863.5	0.55	7954.5	0.18	0.9	0.3	0.75	0.55
E	73822	1.69	66439.8	1.53	7382.2	0.17	0.9	0.3	0.84	1.42
	105640	2.43	90303.3	2.07	15336.7	0.35				1.97
C4 to C3										
C	31818	0.73	23863.5	0.55	7954.5	0.18	0.9	0.3	0.75	0.55
E	73822	1.69	66439.8	1.53	7382.2	0.17	0.9	0.3	0.84	1.42
H	59687	1.37	59687	1.37	0	0.00	0.9	0.3	0.9	1.23
	165327	3.80	149990.3	3.44	15336.7	0.35				3.20
C3 to c2										
C	31818	0.73	23863.5	0.55	7954.5	0.18	0.9	0.3	0.75	0.55
E	73822	1.69	66439.8	1.53	7382.2	0.17	0.9	0.3	0.84	1.42
H	59687	1.37	59687	1.37	0	0.00	0.9	0.3	0.9	1.23
I	31514	0.72	6302.8	0.14	25211.2	0.58	0.9	0.3	0.42	0.30
	196841	4.52	156293.1	3.59	40547.9	0.93				3.51
C2 to C1										
C	31818	0.73	23863.5	0.55	7954.5	0.18	0.9	0.3	0.75	0.55
E	73822	1.69	88439.8	1.53	7382.2	0.17	0.9	0.3	0.84	1.42
H	59687	1.37	59687	1.37	0	0.00	0.9	0.3	0.9	1.23
I	31514	0.72	6302.8	0.14	25211.2	0.58	0.9	0.3	0.42	0.30
P	34684	0.80	8666	0.20	25996	0.60	0.9	0.3	0.45	0.36
	231505	5.31	164959.1	3.79	66545.9	1.53				3.67
C1 to B1										
	231105	5.31	164959.1	3.79	66545.9	1.53				3.67
Alignment #3										
C6 to C5										
C	31818	0.73	23863.5	0.55	7954.5	0.18	0.9	0.3	0.75	0.55

Table 2 - Runoff Coefficient

Sub-Arm	Total Area ft ²	Ana Acres	Impervious ft ²	Acre8	Pervious ft ²	Acre8	Cimp	Cp	Cwt	C*A
Alignment 84										
A1toA2										
G	22102	0.51	22102	0.51	0	0.00	0.9	0.3	0.9	0.46
A2 to A4										
G	22102	0.51	22102	0.51	0	0.00	0.9	0.3	0.9	0.46
F1A	33280	0.76	24960	0.57	8320	0.19	0.9	0.3	0.75	0.57
F1B	25423	0.56	19067.25	0.44	8355.75	0.15	0.9	0.3	0.75	0.44
	80805	1.86	68129.25	1.52	14675.75	0.34				1.47
A4 to A5										
G	22102	0.51	22102	0.51	0	0.00	0.9	0.3	0.9	0.46
F1A	33280	0.76	24980	0.57	8320	0.19	0.9	0.3	0.75	0.57
F1B	25423	0.58	19067.25	0.44	6355.75	0.15	0.9	0.3	0.75	0.44
K	38590	0.89	38590	0.89	0	0.00	0.9	0.3	0.9	0.80
F2	37122	0.85	27841.5	0.64	9280.5	0.21	0.9	0.3	0.75	0.64
	156617	3.69	132560.75	3.04	23966.25	0.55				2.90
A5 to A6										
G	22102	0.51	22102	0.51	0	0.00	0.9	0.3	0.9	0.46
F1A	33280	0.76	24960	0.57	8320	0.19	0.9	0.3	0.75	0.57
F1B	25423	0.58	19067.25	0.44	6355.75	0.15	0.9	0.3	0.75	0.44
K	38590	0.89	38590	0.89	0	0.00	0.9	0.3	0.9	0.80
F2	37122	0.85	27841.5	0.64	9280.5	0.21	0.9	0.3	0.75	0.64
A	176488	4.05	88244	2.03	88244	2.03	0.9	0.3	0.6	2.43
L1	16953	0.44	14214.75	0.33	4730.25	0.11	0.9	0.3	0.75	0.33
	361958	8.08	235019.5	5.40	116938.5	2.88				5.66
A7 to A8										
a	22102	0.51	22102	0.51	0	0.00	0.9	0.3	0.9	0.46
F1A	33280	0.78	24960	0.57	8320	0.19	0.9	0.3	0.75	0.57
F1B	25423	0.58	19067.25	0.44	6355.75	0.15	0.9	0.3	0.75	0.44
K	38590	0.69	38590	0.89	0	0.00	0.9	0.3	0.9	0.80
F2	37122	0.85	27841.5	0.64	9280.5	0.21	0.9	0.3	0.75	0.64
A	176488	4.05	88244	2.03	88244	2.03	0.9	0.3	0.6	2.43
L1	18953	0.44	14214.75	0.33	4738.25	0.11	0.9	0.3	0.75	0.33
L2	26232	0.60	19674	0.45	6558	0.15	0.9	0.3	0.75	0.45
N	29956	0.69	28458.2	0.65	1497.8	0.03	0.9	0.3	0.87	0.60
M	45327	1.04	43060.65	0.99	2266.35	0.05	0.9	0.3	0.87	0.91
T	16985	0.39	16135.75	0.37	849.25	0.02	0.9	0.3	0.87	0.34
	470458	10.80	342348.1	7.86	128109.9	2.94				7.96

Table 2 - Runoff Coefficient

Sub-Area	Total Area ft²	Area Acnr	Impervious		Pervious		Cimp	Cp	Cwt	C'A
			ft²	Acres	ft'	Acres				
Alignment #4 (continued)										
A8 to A9										
G	22102	0.51	22102	0.51	0	0.00	0.9	0.3	0.9	0.46
F1A	33280	0.76	24980	0.57	8320	0.19	0.9	0.3	0.75	0.57
F1B	25423	0.58	19067.25	0.44	8355.75	0.15	0.9	0.3	0.75	0.44
K	38590	0.89	38590	0.89	0	0.00	0.9	0.3	0.9	0.80
F2	37122	0.85	27841.5	0.64	9280.5	0.21	0.9	0.3	0.75	0.64
A	176488	4.05	88244	2.03	88244	2.03	0.9	0.3	0.6	2.43
L1	18953	0.44	14214.75	0.33	4738.25	0.11	0.9	0.3	0.75	0.33
R	117263	2.69	11726.3	0.27	105536.7	2.42	0.9	0.3	0.36	0.97
L2	26232	0.60	19874	0.45	6558	0.15	0.9	0.3	0.75	0.45
N	29956	0.69	28458.2	0.85	1497.8	0.03	0.9	0.3	0.87	0.60
M	45327	1.04	43060.65	0.99	2266.35	0.05	0.9	0.3	0.87	0.91
T	16985	0.39	16135.75	0.37	849.25	0.02	0.9	0.3	0.87	0.34
	587721	13.49	354074.4	8.13	233646.6	5.36				8.92
A9 to A10										
G	22102	0.51	22102	0.51	0	0.00	0.9	0.3	0.9	0.46
F1A	33280	0.76	24960	0.57	8320	0.19	0.9	0.3	0.75	0.57
F1B	25423	0.58	19067.25	0.44	8355.75	0.15	0.9	0.3	0.75	0.44
K	38590	0.89	38590	0.89	0	0.00	0.9	0.3	0.9	0.80
F2	37122	0.85	27841.5	0.64	9280.5	0.21	0.9	0.3	0.75	0.64
A	176488	4.05	88244	2.03	88244	2.03	0.9	0.3	0.6	2.43
L1	18953	0.44	14214.75	0.33	4738.25	0.11	0.9	0.3	0.75	0.33
R	117263	2.69	11726.3	0.27	105536.7	2.42	0.9	0.3	0.36	0.97
L2	26232	0.60	19674	0.45	6558	0.15	0.9	0.3	0.75	0.45
N	29956	0.69	28458.2	0.65	1497.8	0.03	0.9	0.3	0.87	0.60
M	45327	1.04	43060.65	0.99	2268.35	0.05	0.9	0.3	0.87	0.91
T	16985	0.39	16135.75	0.37	849.25	0.02	0.9	0.3	0.87	0.34
S	89291	2.05	26787.3	0.61	62503.7	1.43	0.9	0.3	0.48	0.98
	677012	15.54	380861.7	8.74	296150.3	6.80				9.91
A10 to D2										
North end of INTEC	2613600	60.00	871112.88	20.00	1742487.12	40.00	0.9	0.3	0.49998	30.00
Alignment #5										
C7 to C4A										
H1	30000	0.69	30000	0.69	0	0.00	0.9	0.3	0.9	0.82
	30000	0.69	30000	0.69	0	0.00				0.62

Table 2 - Runoff Coefficient

Sub-Area	Total Area ft ²	Ana Acres	Impervious ft ²	Acres	Pervious ft ²	Acres	Cimp	Cp	Cwt	C*A
Alignment #6										
A4A to M										
K	38590	0.89	38590	0.89	0	0.00	0.9	0.3	0.9	0.80
B6 to B4										
M	45327	1.04	43060.65	0.99	2266.35	0.05	0.9	0.3	0.87	0.91
	45327	1.04	43060.65	0.99	2266.35	0.05				0.91
B4 to A7										
N	29956	0.69	28458.2	0.65	1497.8	0.03	0.9	0.3	0.87	0.60
M	45327	1.04	43060.65	0.99	2266.35	0.05	0.9	0.3	0.87	0.91
T	16985	0.39	16135.75	0.37	849.25	0.02	0.9	0.3	0.87	0.34
	92268	2.12	87654.6	2.01	4613.4	0.11				1.84
Alignment #7										
B5 to B4										
N	29956	0.69	28458.2	0.65	1497.8	0.03	0.9	0.3	0.87	0.60
Alignment #8										
B2 to B1										
O	30993	0.71	29443.35	0.68	1549.65	0.04	0.9	0.3	0.87	0.62
Q	71328	1.64	67761.6	1.56	3566.4	0.08	0.9	0.3	0.87	1.42
	102321	2.35	97204.95	2.23	5116.06	0.12				2.04
B1 to D1										
O	30993	0.71	29443.35	0.68	1549.65	0.04	0.9	0.3	0.87	0.62
Q	71328	1.84	67761.6	1.56	3566.4	0.08	0.9	0.3	0.87	1.42
U	18933	0.43	1893.3	0.04	17039.7	0.39	0.9	0.3	0.36	0.16
C	31818	0.73	23883.5	0.55	7954.5	0.18	0.9	0.3	0.75	0.55
E	73822	1.69	66439.8	1.53	7382.2	0.17	0.9	0.3	0.84	1.42
H	59687	1.37	59687	1.37	0	0.00	0.9	0.3	0.9	1.23
I	31514	0.72	6302.8	0.14	25211.2	0.58	0.9	0.3	0.42	0.30
P	34664	0.80	8668	0.20	25998	0.60	0.9	0.3	0.45	0.36
	352759	8.10	264067.36	6.06	88701.65	2.04				6.07
D1 to D2										
O	30993	0.71	29443.35	0.68	1549.65	0.04	0.9	0.3	0.87	0.62
Q	71328	1.64	67761.6	1.58	3566.4	0.08	0.9	0.3	0.87	1.42
U	18933	0.43	1693.3	0.04	17039.7	0.39	0.9	0.3	0.36	0.16
C	31818	0.73	23863.5	0.55	7954.5	0.18	0.9	0.3	0.75	0.55
E	73822	1.69	66439.8	1.53	7382.2	0.17	0.9	0.3	0.84	1.42
H	59687	1.37	59667	1.37	0	0.00	0.9	0.3	0.9	1.23
I	31514	0.72	6302.8	0.14	25211.2	0.58	0.9	0.3	0.42	0.30
P	34664	0.80	8666	0.20	25998	0.60	0.9	0.3	0.45	0.36
	362759	8.10	264057.35	6.06	88701.66	2.04				6.07
D3 to D4										
V	726802	16.69	399741.1	9.18	327060.9	7.51	0.9	0.3	0.63	10.51

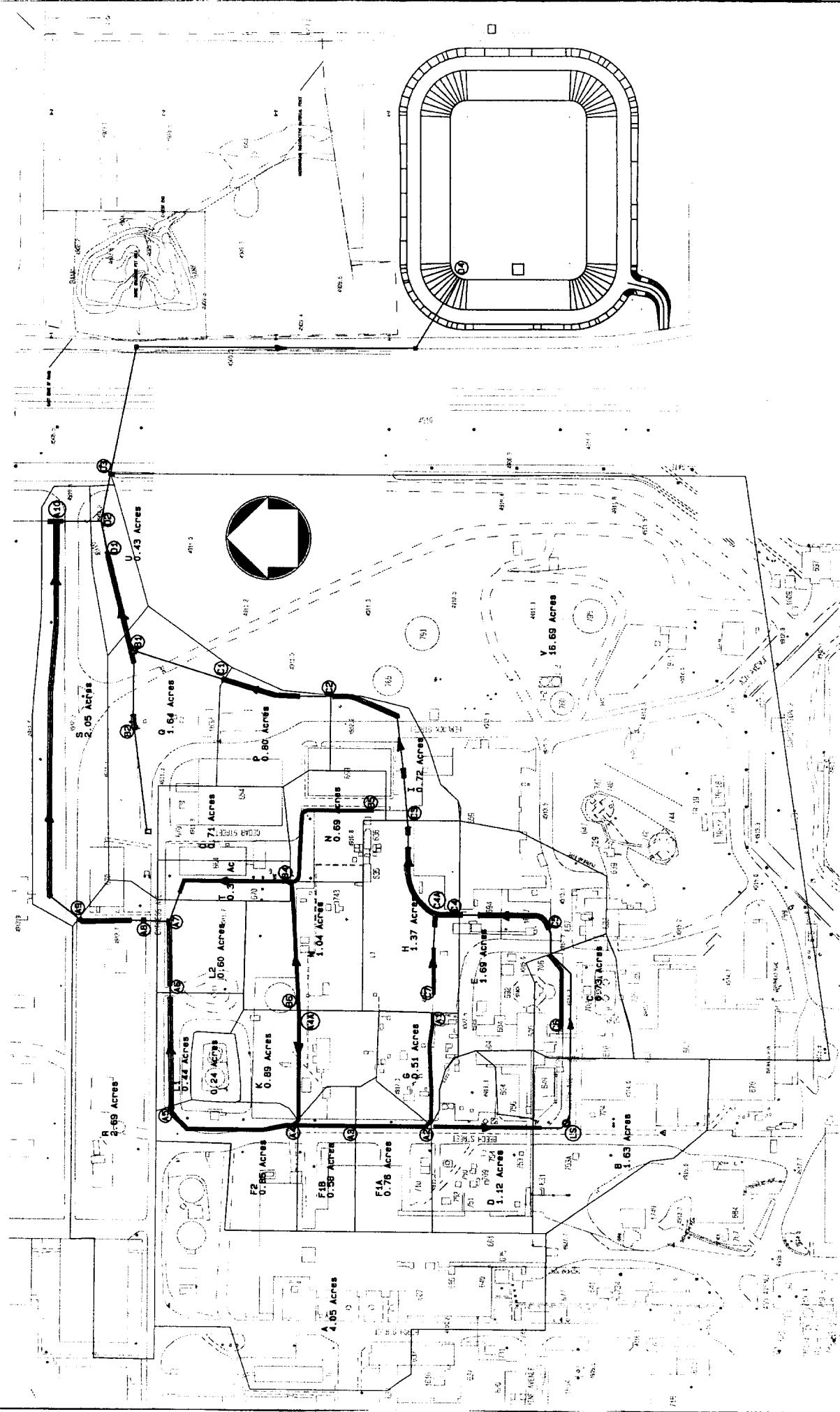
Table 3 Profile Data

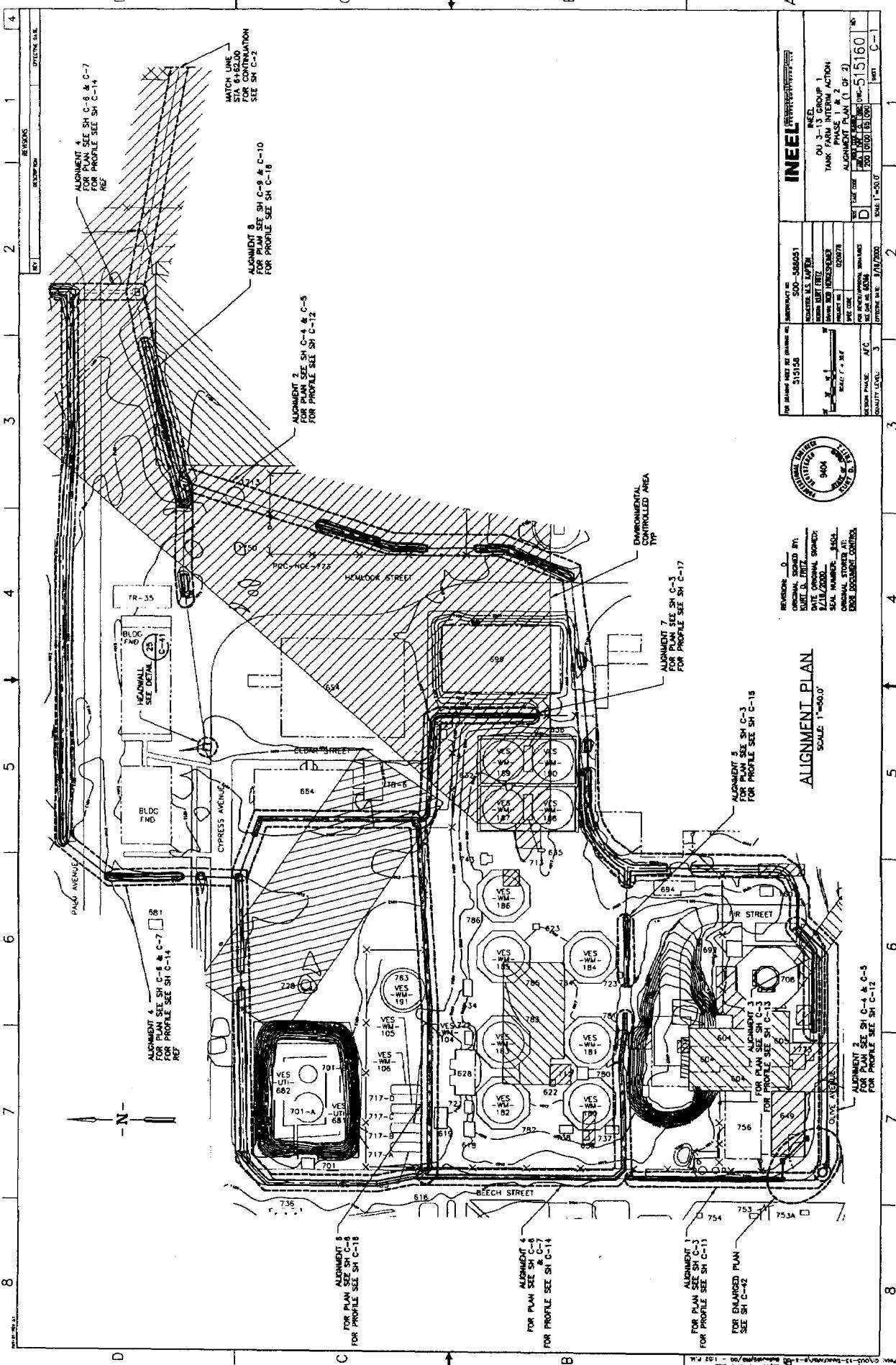
Feature	Beg Station	End Station	Beg Invert Elevation	End Invert Elevation	Length (ft)	Delta Elevation	Slope (%)	Design Flow (cfs)	Capacity (cfs)	Velocity (ft/sec)	Travel Time (min)	Headwall Water Depth (in) ¹
Profile 1												
1 2 PVC Pipe	of-00 00	0+51 93	4909 4	4908 5	51 93	0 9	1.73	2.72	6.77			
8" Trench Drain	0+51 93	2+41 13	4913 4	4911 69	189 2	1 71	a 90	2.72	10			
Profile 2												
Type 3 Ditch	3+65 97	5+02 02	4912 6	4912 33	136 05	a 27	0 20	5.88	30.29	4.49	0 51	
28"x20" CMPA	5+02 02	5+33 02	4912 33	4912 24	31	0 09	0 29	5.88	6.6	2.1	0 25	13 44
Type 3 Ditch	5+33 02	7+19 20	4912 24	4911 68	186 IS	0 56	0 30	7.59	37.09	5.5	0 56	
28"x20" CMPA	7+19 20	7+43 20	4911 68	4911 56	24	0 12	0 50	7.59	8.66	2.76	0 14	15 a4
Type 3 Ditch	7+43 20	7+56 06	4911 56	4911 5	12 86	0 06	0 47	7.59	46.43	6.88	a 03	
28"x20" CMPA	7+56 06	8+46 06	4911 5	4970 99	90	0 51	0 57	7.98	9.25	2.94	0 51	15 96
Type 3 Ditch	8+46 06	8+62 38	4910 99	4910 85	16 32	0 14	0 86	7.98	62.8	9.3	0 03	
Exist 24"x30" CMPA	8+62 38	9+55 10	4910 85	4909.51	92 72	1 34	1 45	7.98	14.75	4.7	0 33	17 28
Type 3 Ditch	9+55 10	10+79 10	4909 51	4908 8	124	0 71	0 57	7.98	51.13	7.57	0 27	
28"x20" CMPA	10+79 10	11+39.10	4908 a	4908 4	60	a 4	0 67	8.41	10.03	3.19	0 31	17 04
Type 3 Ditch	11+39 10	12+78 86	4908 4	4907 45	139 76	0 95	1 68	8.41	55.84	8.27	0 28	
Exist 36" CMP	12+78 86	14+40 30	4907.45	4906 9	161 44	0 55	0 34	8.41	21.07	2.98	0 90	14 4
Type 3 Ditch	14+40 30	14+51 39	4906 9	4906 47	11 09	0 43	3 88	8.41	274.65	22 9	0 01	
Profile 3												
Type 1 Ditch	0+00.00	1+35 58	4913 2	4912 93	135 58	0 27	0 20	0.93	2.5	2	1.13	
12" CMP	1+35.58	1+84.58	4912 93	4912 6	49	0 33	0 67	0.93	1.58	2	0 41	7.2
Profile 4												
Type 1 Ditch	0+00 00	1+40 27	4916 8	4916	140 23	0 e	0 57	0.82	4.23	3.38	0 69	
Type 1 Ditch	1+40 27	2+07 35	4916	4914	67 08	2	2 98	0.82	9.66	7.7	0 15	
Type 1 Ditch	2+07 35	4+43 55	4914	4913 05	236 2	0 95	0 40	2.49	3.54	2.83	1 39	
Type 2 Ditch	4+43 55	6+80 29	4913 05	4912 1	236 74	0 95	0 40	4.79	6.15	3.28	1 20	
Type 3 Ditch	6+80 29	8+79 90	4911	4910 6	199 61	0 4	0 20	9.00	30.29	4.49	0 74	
24" CMP	8+79 90	9+01 90	4910 6	4910 4	22	0 2	0 91	9.00	11.69	3.72	0 10	18 72
Type 3 Ditch	9+01 90	10+20 65	4910 4	4910 14	118 95	0 26	0 22	9.00	31.76	4.71	0 42	
24" CMP	10+20 85	10+60.85	4910 14	4909 74	40	0 4	1.00	12.09	12.25	3.9	0 17	22 56
Concrete Structure	10+60 85	10+66 26	4909 74	4909 57	5 41	0 17	3 14	13.30	182.29	20 25	0 00	
Exist 24" CMP	10+66 26	10+86 26	4909 57	4909 36	20	0 21	1 05	13.30	12.56	4	0 08	26 4
Type 3 Ditch	10+86 26	11t78 64	4909 36	4909 17	92 38	a 19	0 21	13.87	31.03	4.6	0 33	
30" CMP	11+78 64	12+42 64	4909 17	4908 95	64	0 22	0 34	13.87	12.95	2.64	0 40	21 96
Type 3 Ditch	12+42 64	18+97 00	4908 95	4907 51	654 36	1 44	0 22	13.87	31.76	4.7	2 32	
Type 3 Ditch	18+97 00	19+22 55	4907 51	4907 11	25 55	a 405	1 59	13.87	85.39	12.7	0 03	
Exist 40"x28" CMPA	19+22 55	19+90 82	4906 95	4906 26	68 27	0 69	1.01	30.00	36.31	5.14	0 22	30 e4

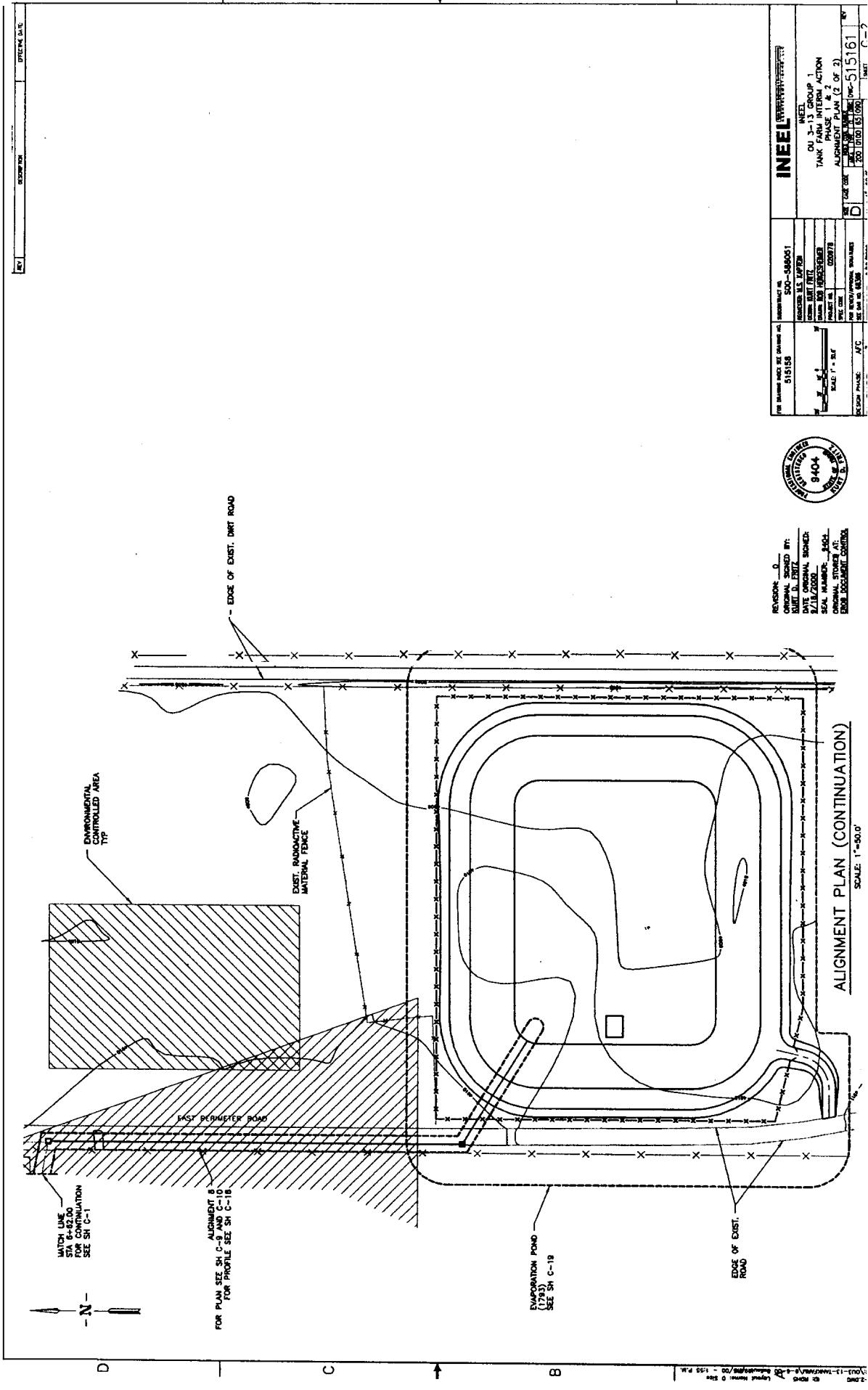
Table 3 - Profile Data

Feature	Beg Station	End Station	Beg Invert Elevation	End Invert Elevation	Length (ft)	Delta Elevation	Slope (%)	Design Flow (cfs)	Capacity (cfs)	Velocity (ft/sec)	Travel Time (min)	Headwall Water Depth (in) ¹
Profile 5												
Type 1 Ditch	0+00.00	0+63.29	4916.3	4915.55	63.29	0.75	1.19	1.12	6.1	4.9	0.22	-
Type 1 Ditch	0+63.29	0+82.80	4915.55	4914.18	19.51	1.37	7.02	1.12	14.83	11.9	0.03	-
Exist 18" CMP	0+82.80	1+22.80	4914.18	4913.67	40	0.51	1.28	1.12	6.44	3.6	0.19	5.4
Type 3 Ditch	1+22.80	1+44.52	4913.67	4912.1	21.72	1.57	7.23	1.12	182.09	27	0.01	-
Profile 6												
Type 1 Ditch	0+00.00	2+00.64	4914.12	4913.05	200.64	1.07	0.53	1.37	4.07	3.3	1.01	-
Type 1 Ditch	2+00.64	4+46.98	4914.12	4912.07	246.34	2.05	0.83	1.54	5.1	4	1.03	-
Type 1 Ditch	4+46.98	6+54.29	4912.07	4910.67	207.31	1.4	0.68	3.04	4.61	3.7	0.93	-
18" CMP	6+54.29	7+08.29	4910.67	4910.4	54	0.27	0.50	3.04	4.02	2.3	0.39	11.16
Profile 7												
Type 1 Ditch	0+00.00	2+65.84	4912.6	4912.07	265.84	0.53	0.20	1.08	2.5	2	2.22	-
Profile 8												
Type 3 Ditch	0+00.00	0+26.50	4908	4907.29	26.5	0.71	2.68	3.07	110.86	16.42	0.03	-
Exist 42"x30" CMPA	0+26.50	1+20.38	4907.29	4906.52	93.88	0.77	0.82	3.07	32.71	4.63	0.34	9
Type 3 Ditch	1+20.38	3+24.03	4906.52	4906.11	203.65	0.41	0.20	11.21	30.29	4.49	0.76	-
52"x32" CMPA	3+24.03	3+77.09	4906.11	4905.9	53.06	0.21	0.40	11.21	39.02	3.7	0.24	13.8
Exist Manhole	3+77.09	3+85.57	4905.9	4904.76	N/A	1.14	N/A	N/A	N/A	-	-	-
Exist 52"x32" CMPA	3+85.57	4+21.72	4904.76	4904.04	36.15	0.72	1.99	43.94	87.03	8.24	0.07	N/A
Exist Manhole	4+21.72	4+30.20	4904.04	4902.04	N/A	2	N/A	N/A	N/A	-	-	-
Exist 52"x32" CMPA	4+30.20	4+67.72	4902.04	4901.89	37.52	0.15	0.40	43.94	39.02	3.7	0.17	N/A
Exist 58"x36" CMPA	4+67.72	6+98.81	4901.89	4900.83	231.09	1.06	0.46	55.50	52.77	4.2	0.92	N/A
Manhole	6+98.81	7+05.81	4900.83	4900.83	N/A	N/A	N/A	N/A	N/A	-	-	-
48" CMP	7+05.81	13+44.61	4900.83	4897.61	638.8	3.22	0.50	55.50	55.01	4.38	2.43	N/A

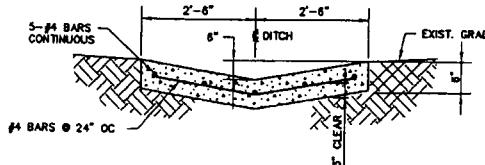
1.) Headwater depths were calculated using the nomographs on pages 25 and 26.







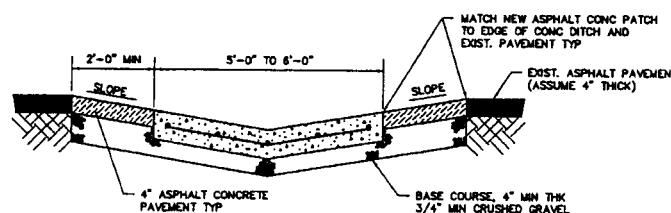
REV	DESCRIPTION	EFFECTIVE DATE
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TYP CONCRETE DITCH DETAIL 11
TYPE 1 NTS REF C-8
C-8

NOTES

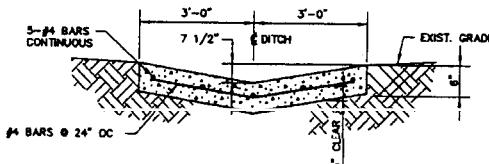
1. PROVIDE IMPRESSED CONTRACTION JOINTS AT 5'-0" OC MAXIMUM.
2. PROVIDE EXPANSION JOINTS AT 40'-0" OC MAXIMUM. SEE TYP DETAIL THIS SHEET.



TYP CONCRETE DITCH THROUGH PAVEMENT DETAIL 14
NTS REF C-8

NOTES

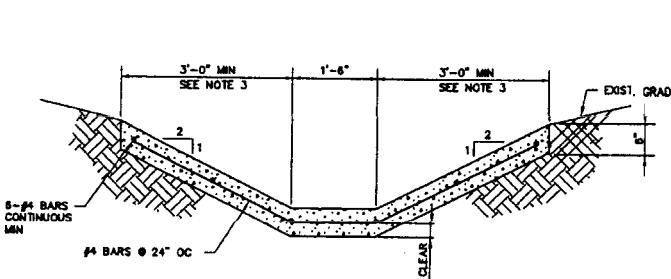
1. ALL AREAS TO BE PATCHED SHALL HAVE THE EXISTING PAVEMENT SAW CUT TO CLEAN STRAIGHT LINES.
2. EDGES OF EXISTING PAVEMENT AND NEW CONCRETE SHALL HAVE A TACK COAT APPLIED PRIOR TO THE PLACEMENT OF NEW ASPHALT CONCRETE.



TYP CONCRETE DITCH DETAIL 12
TYPE 2 NTS

NOTES

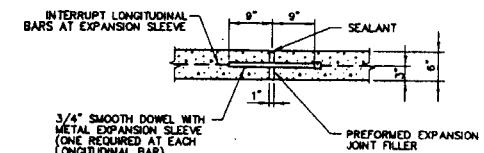
1. PROVIDE IMPRESSED CONTRACTION JOINTS AT 5'-0" OC MAXIMUM.
2. PROVIDE EXPANSION JOINTS AT 40'-0" OC MAXIMUM. SEE TYP DETAIL THIS SHEET.



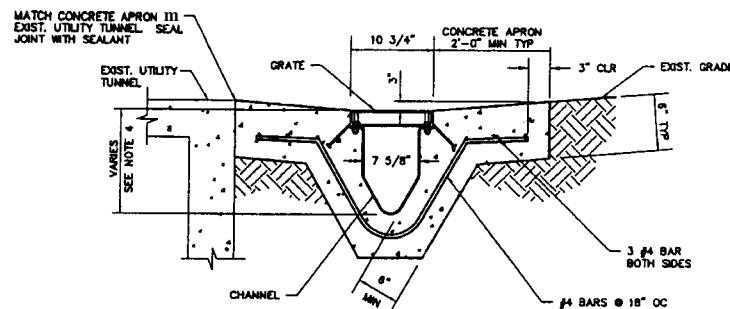
TYP CONCRETE DITCH DETAIL 13
TYPE 3 NTS REF

NOTES

1. PROVIDE IMPRESSED CONTRACTION JOINTS AT 5'-0" OC MAXIMUM.
2. PROVIDE EXPANSION JOINTS AT 40'-0" OC MAXIMUM. SEE TYP DETAIL THIS SHEET.
3. CONCRETE DITCH SHALL EXTEND TO THE TOP OF EXISTING DITCH BANK.



TYP EXPANSION JOINT DETAIL NTS



TYP 8" TRENCH DRAIN SECTION A
NTS REF C-3

NOTES

1. PROVIDE IMPRESSED CONTRACTION JOINTS AT 5'-0" OC MAXIMUM.
2. PROVIDE EXPANSION JOINTS AT 50'-0" OC MAXIMUM.
3. INSTALL PER MANUFACTURERS RECOMMENDATIONS.
4. DEPTH VARIES FROM 5 1/2" TO 29 1/2", SEE MANUFACTURERS DATA.

REVISION 0
ORIGINAL SIGNED BY:
KURT D. FRITZ
DATE ORIGINAL SIGNED:
9/18/2000
SEAL NUMBER: 8404
ORIGINAL STORED AT:
EROS DOCUMENT CONTROL



FOR DRAWING INDEX SEE DRAWING NO. 515158	SUBCONTRACT NO. 500-588051	INEEL PROFESSIONAL SERVICES 9404 NO SCALE DESIGN PHASE: AFC QUALITY LEVEL: 3
RELEASER M.S. KAPTON	RELEASER M.S. KAPTON	
KURT D. FRITZ BRIAN ROB HERGEMER	RELEASER M.S. KAPTON	
PROJECT NO. 020078	PROJECT NO. 020078	
SPEC. CODE:	SPEC. CODE:	
FOR REVIEW/APPROVAL SIGNATURE SEE DAY NO. 85388	FOR REVIEW/APPROVAL SIGNATURE SEE DAY NO. 85388	
DRAWING NUMBER: DWG-515192 REV		
DRAWN BY: KURT D. FRITZ		
SCALE: None		
EFFECTIVE DATE: 9/18/2000		
SHEET C-33		

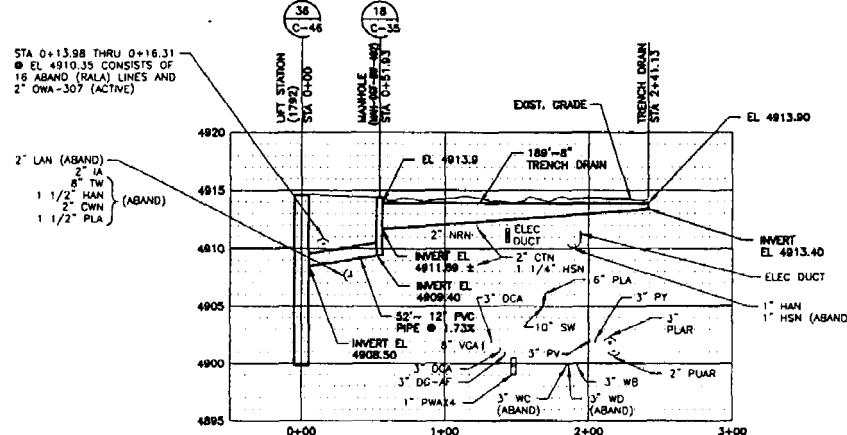
8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | REVISIONS
REV DESCRIPTION EFFECTIVE DATE

D

C

B

A



ALIGNMENT 1 PROFILE REF

SCALE: HOR 1"-40'
VER 1"-5'

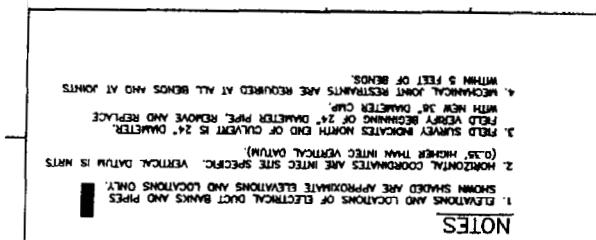
REVISION: 0
ORIGINAL SIGNED BY:
KURT D. FRITZ
DATE ORIGINAL SIGNED:
8/18/2000
SEAL NUMBER: 9404
ORIGINAL STORED AS:
EROD DOCUMENT CONTROL



NOTES

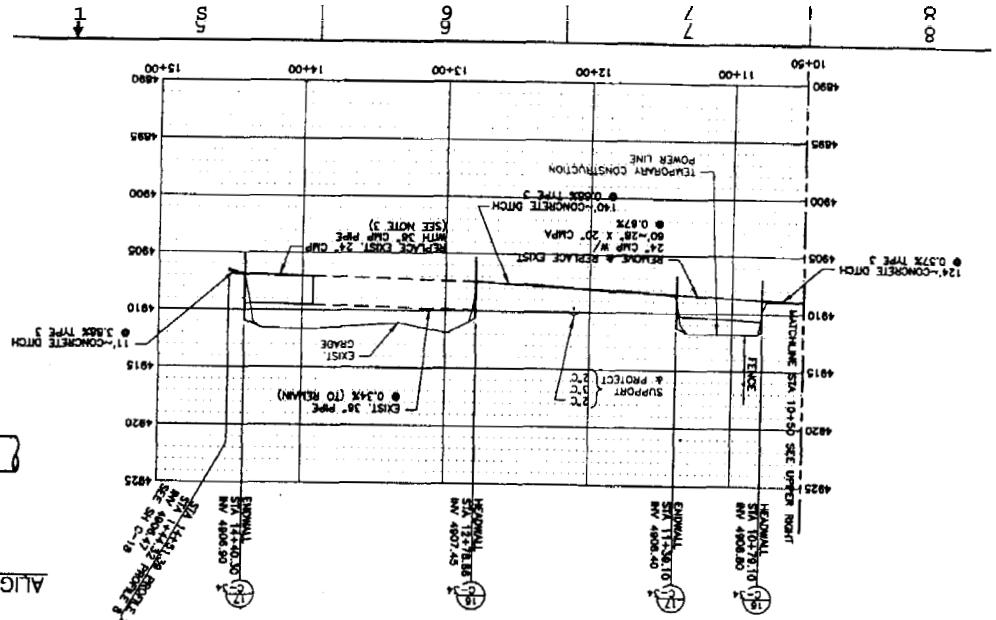
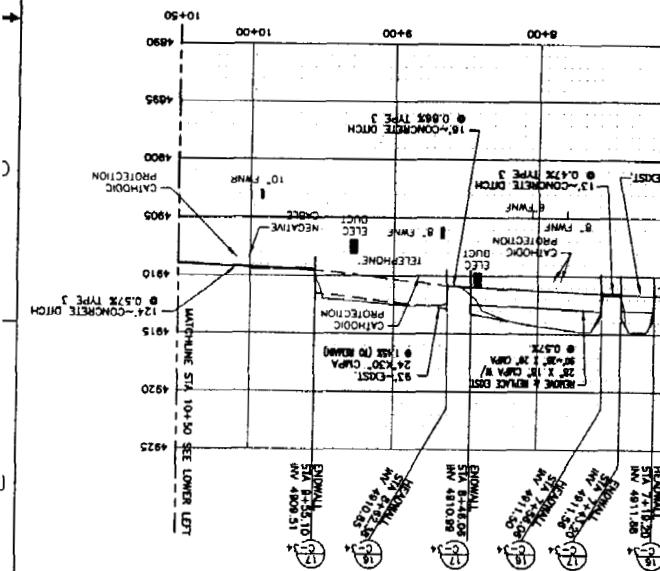
- ELEVATIONS AND LOCATIONS OF ELECTRICAL DUCT BANKS AND PIPES SHOWN SHADeD ARE APPROXIMATE ELEVATIONS AND LOCATIONS ONLY.
- HORIZONTAL COORDINATES ARE INTEC SITE SPECIFIC. VERTICAL DATUM IS NRTS (0.35' HIGHER THAN INTEC VERTICAL DATUM).

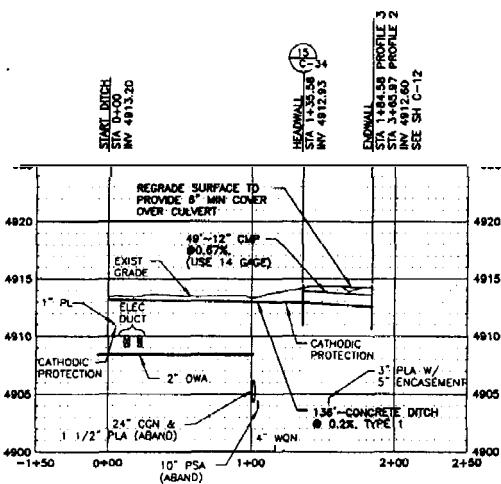
FOR DRAWING NO. SEE DRAWING NO. 515158	PROJ. NO. SOO-598051	INTEL
SIGNED BY KURT D. FRITZ	REGISTERED U.S. PATENT AND TRADEMARK OFFICE	OU 3 - GROUP 1
DATE SIGNED 8/18/2000	STYLING REG. HONORABLE PARKER	TANK FARM INTERIM ACTION
SEAL NUMBER 9404	PERMIT NO. 000078	PHASE 1 & 2
ORIGINAL STORED AS EROD DOCUMENT CONTROL	PERIOD ONE YEAR	ALIGNMENT 1 PROFILE
SIGN HERE/INITIALS KURT D. FRITZ		REV. CASE NO. D 200 (110) 02 (00)
QUALITY LEVEL 3		NOTE NO. D-515170
EFFECTIVE DATE 8/18/2000		RECD. NOTED SHEET C-11



A technical drawing of a steel pipe bend. The bend has a central vertical section labeled "STEEL PIPE". To its left is a horizontal section labeled "SCH 40". Below the vertical section is a horizontal section labeled "PIPE LINE". At the bottom left, there is a small circle with the number "8" and the text "INCHES".

ALIGNMENT 2 PROFILE 865 G-1 G-2 G-3 G-4





ALIGNMENT 3 PROFILE

SCALE: HOR 1'-0"
VER 1'-5"

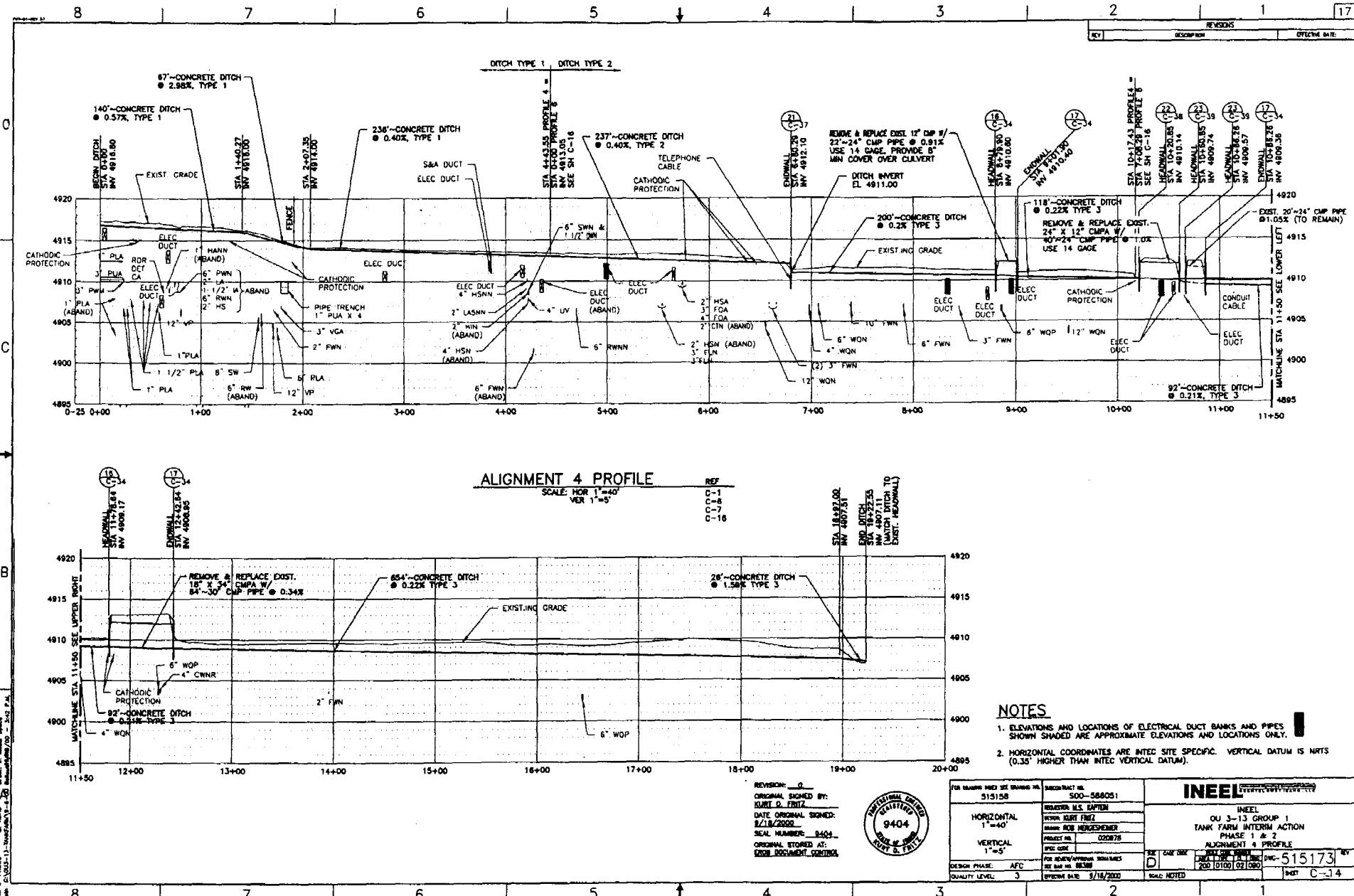
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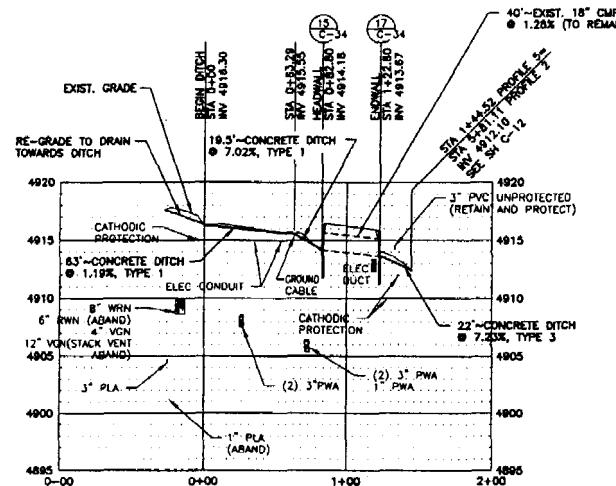
1. ELEVATIONS AND LOCATIONS OF ELECTRICAL DUCT BANKS AND PIPES SHOWN SHADED ARE APPROXIMATE ELEVATIONS AND LOCATIONS ONLY.
 2. HORIZONTAL COORDINATES ARE INTEC SITE SPECIFIC. VERTICAL DATUM IS NRTS (0.35' HIGHER THAN VERTICAL DATUM).

REVISION: 0
ORIGINAL SIGNED BY:
KURT D. FRITZ
DATE ORIGINAL SIGNED:
9/18/2000
SEAL NUMBER: 9404
ORIGINAL STORED AT:
EROS DOCUMENT CONTROL



6 | 5 t 4 | 3





ALIGNMENT 5 PROFILE

REVISION: D
ORIGINAL SIGNED BY:
KURT D. FRITZ
DATE ORIGINAL SIGNED:
9/18/2000
SEAL NUMBER: 8404
ORIGINAL STORED AT:
DROP DOCUMENT CONTROL



NOTES

- 1. ELEVATIONS AND LOCATIONS OF ELECTRICAL DUCT BANKS AND PIPES
SHOWN SHADED ARE APPROXIMATE ELEVATIONS AND LOCATIONS ONLY.**

**2. HORIZONTAL COORDINATES ARE INTEC SITE SPECIFIC. VERTICAL DATUM IS NRTS
(0.35' HIGHER THAN INTEC VERTICAL DATUM).**

FOR DRAWING INDEX SEE DRAWING NO.	SUPERSEDED BY NO.	INEEL
515158	500-568051	INTEL
REDACTOR: M.S. KAPFER		OU 3-13 GROUP 1
REVIEW: JAMES FISHER		TANK FARMER'S DAY ACTION
APPROVAL: J. SCHAFFNER		PHASE 1 & 2
DATE: 02/07/01		ALIGNMENT 3 PROFILE
HORIZONTAL 1"=40'		D
VERTICAL 1"=5"		SCALE: 1/4" = 100'
FOR APPROVAL/INITIALS: M.S. KAPFER		DATE: 02/07/01
DESIGN PHASE: AFC		BY: 010001 02 0800
QUALITY LEVEL:	3	DOC NO.: DNG-5151574-N
DRAWN BY: J. SCHAFFNER		DATE: 02/07/01
CHECKED BY: J. SCHAFFNER		BY: 010001 02 0800
APPROVED BY: J. SCHAFFNER		DATE: 02/07/01
REV'D BY: J. SCHAFFNER		BY: 010001 02 0800
SCALE NOTED		SHEET C-15
1/16/2000		

A circular library stamp with the text "STATE LIBRARY OF NEW SOUTH WALES" around the perimeter and "1961" in the center.

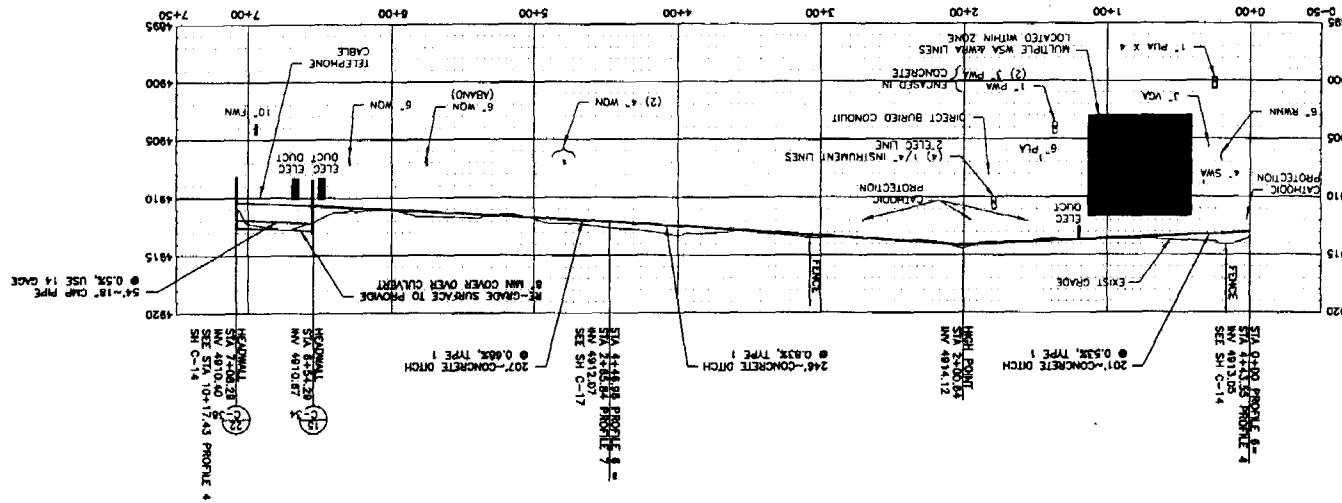
SEARCHED INDEXED SERIALIZED FILED
APR 18 2002
FBI - MEMPHIS
LABORATORY DIVISION

卷之三

DELTASONS SHOWN AND APPROXIMATE LOCATIONS OF ELECTRONIC OUT-PORT BARS AND PIPS. SHOWN SHAPES ARE APPROXIMATE ELETTOMS AND DELTASONS ONLY.

SEIION

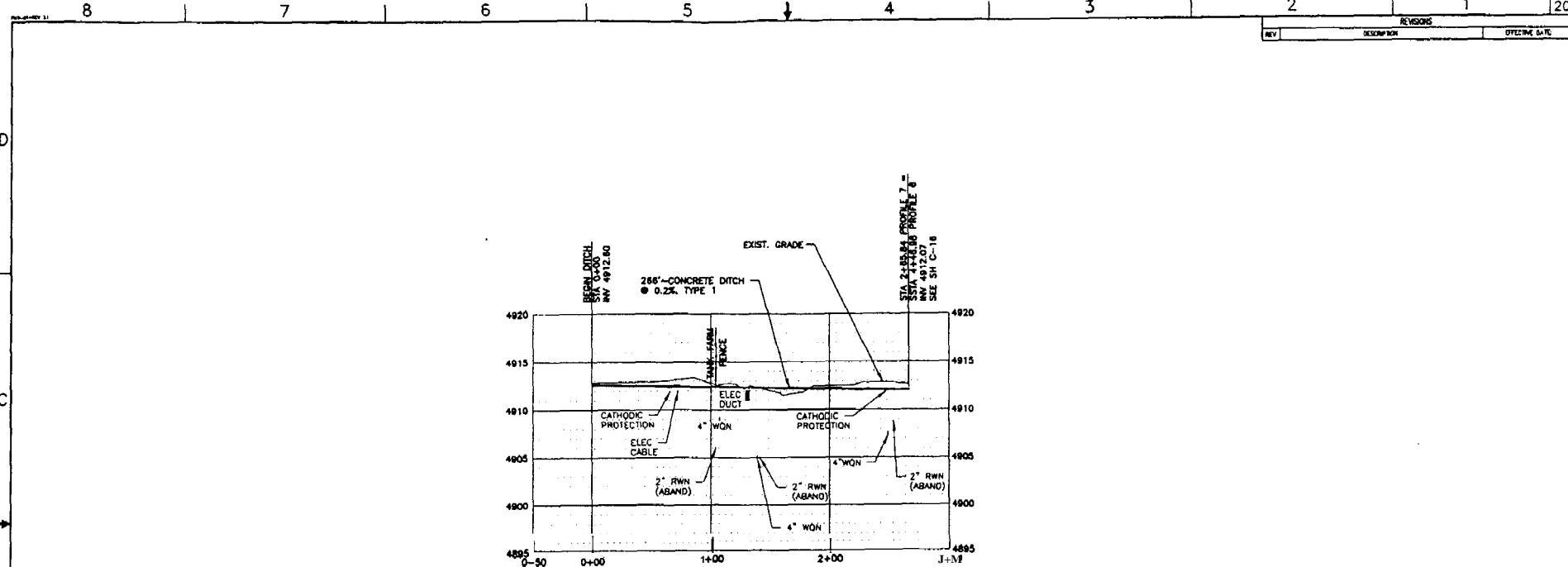
ALIGNMENT 6 PROFILE
REF C-1 C-2 C-3 C-4 C-5 C-6 C-7
SCALE: 1 IN. = .005
VER. 1-50



61

20/20

REV	DESCRIPTION	EFFECTIVE DATE
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ALIGNMENT 7 PROFILE

SCALE: HOR 1"-40'
VER 1"-5'

REF:
C-1
C-2
C-16

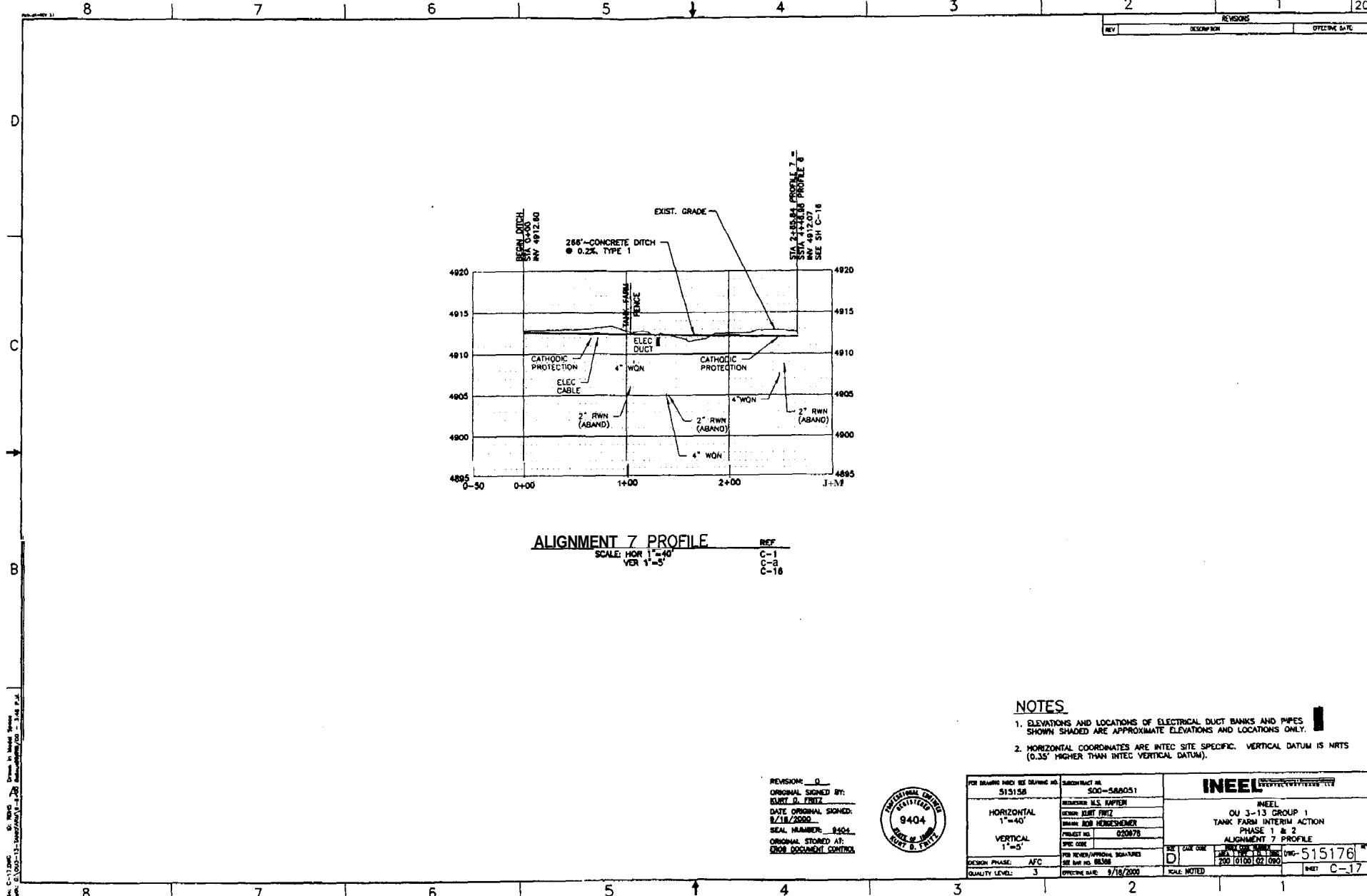
NOTES

1. ELEVATIONS AND LOCATIONS OF ELECTRICAL DUCT BANKS AND PIPES SHOWN SHADED ARE APPROXIMATE ELEVATIONS AND LOCATIONS ONLY.
2. HORIZONTAL COORDINATES ARE INTEC SITE SPECIFIC. VERTICAL DATUM IS NRTS (0.35' HIGHER THAN INTEC VERTICAL DATUM).

REVISION: 0
ORIGINAL SIGNED BY:
KURT D. FRITZ
DATE ORIGINAL SIGNED:
9/18/2000
SEAL NUMBER: 8404
ORIGINAL STORED AT:
GROS DOCUMENT CONTROL

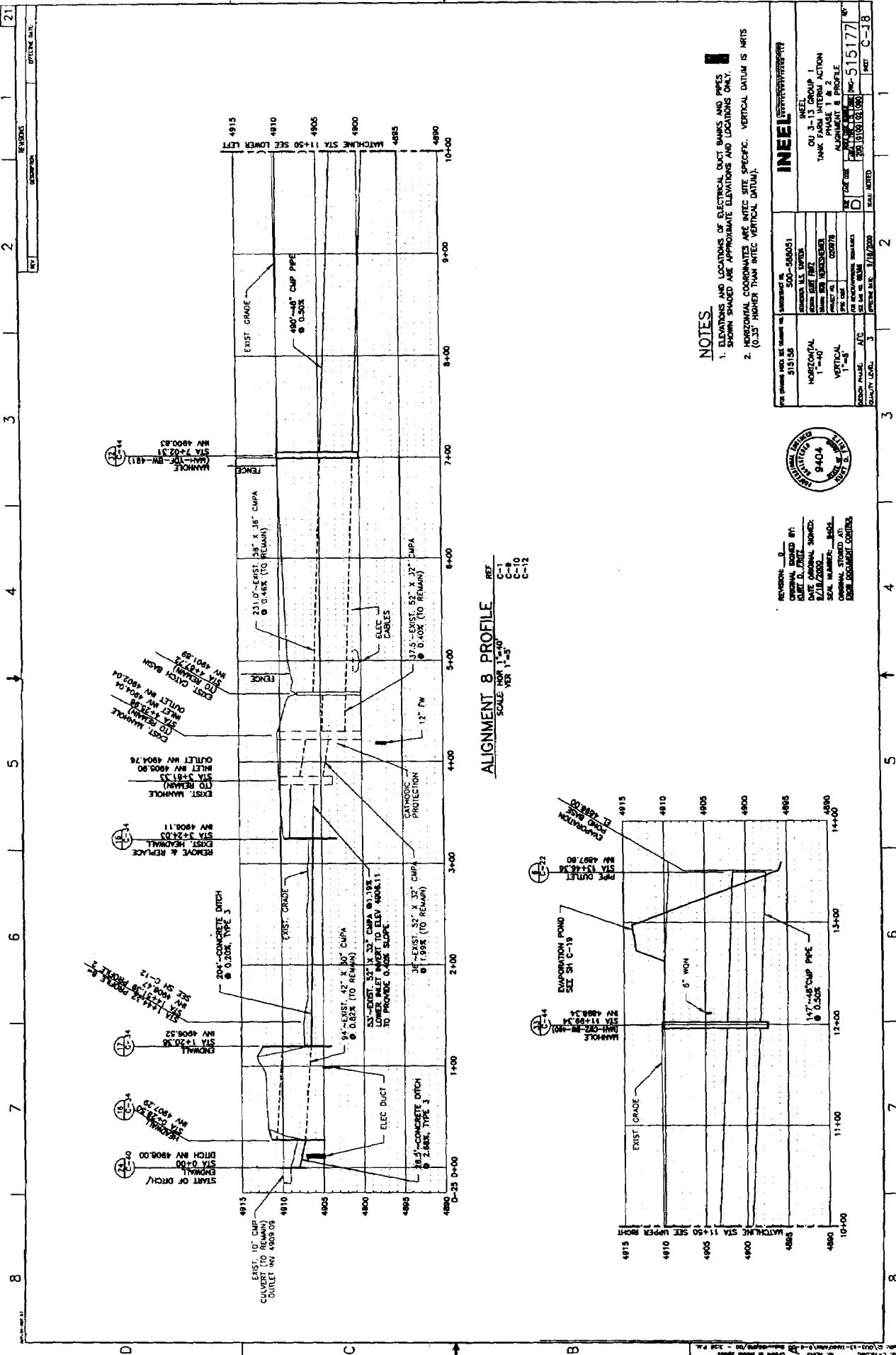


FOR DRAWING INFO SEE DRAWING NO. 515156	CONTRACT NO. 500-588051	INEEL INTERIM ACTION PHASE 1 & 2 ALIGNMENT 7 PROFILE
REVISOR: KLS KAPLEN 9404	DESIGNER: KURT D. FRITZ DRAWER: ROB HORNEMEIER PROJECT NO.: 020678	INEEL OU 3-13 GROUP 1 TANK FARM INTERIM ACTION PHASE 1 & 2 ALIGNMENT 7 PROFILE
HORIZONTAL 1"-40'	VERTICAL 1"-5"	DATE DRAWN 9/18/2000 DATE REV'D/PROV'D SIGNATURES SEE DAY NO. 86368 QUALITY LEVEL: 3 EFFECTIVE DATE 9/18/2000 SCALE NOTED 1:1000 INSET C-17



21/26

21



CANADA

FIGURE I

**STATE OF IDAHO
AREA CLASSIFICATION MAP**

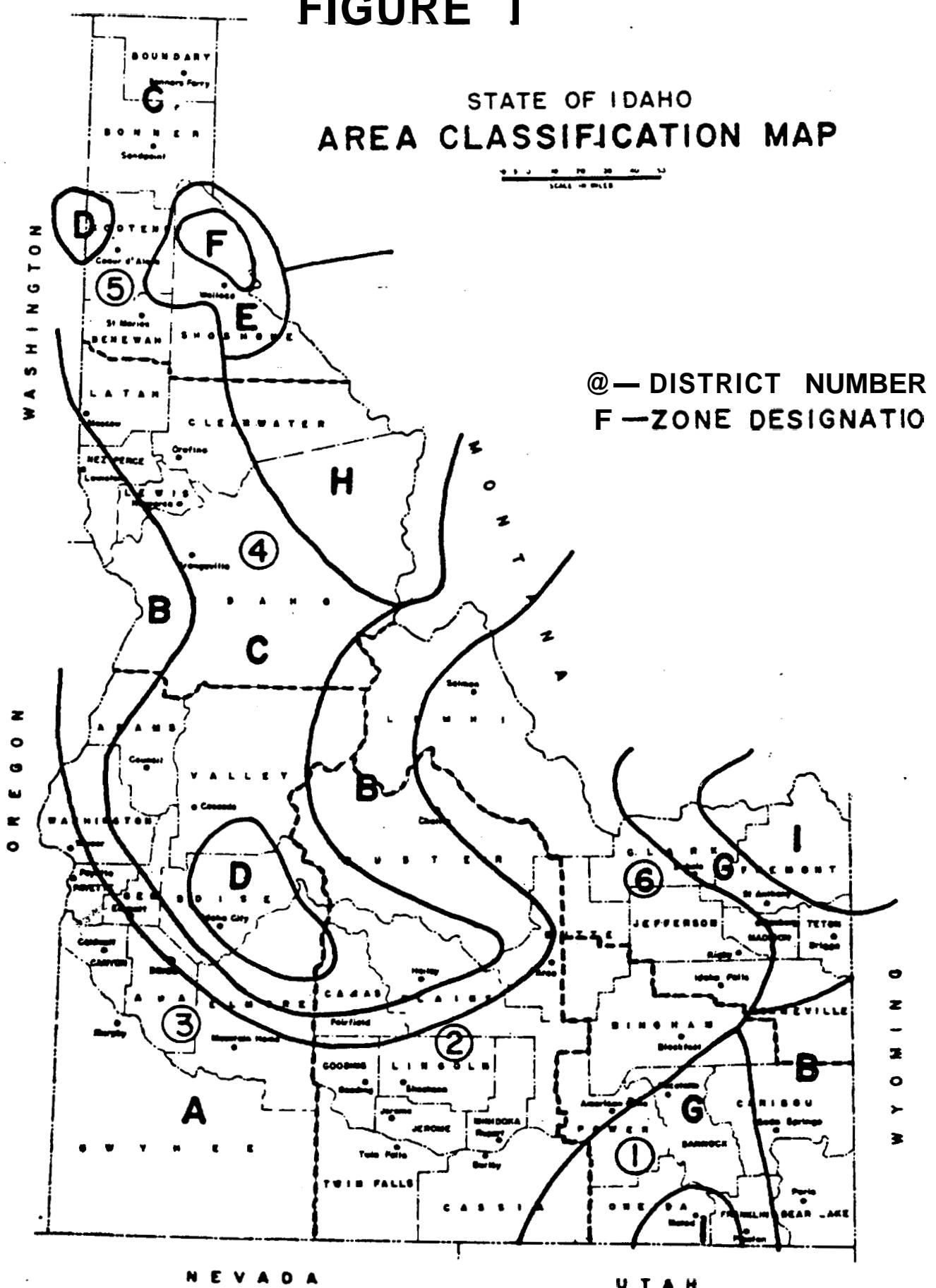


FIGURE I-A

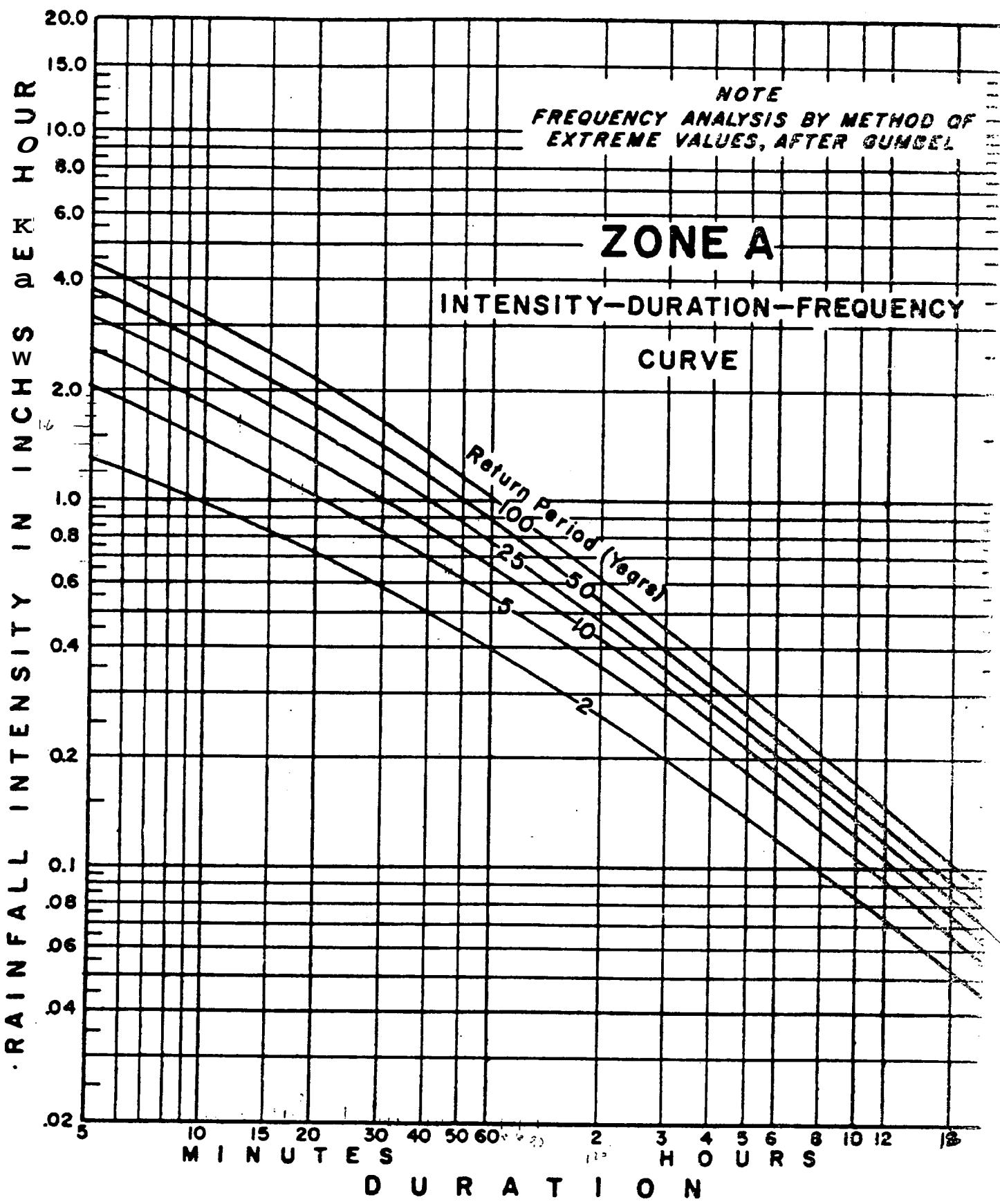
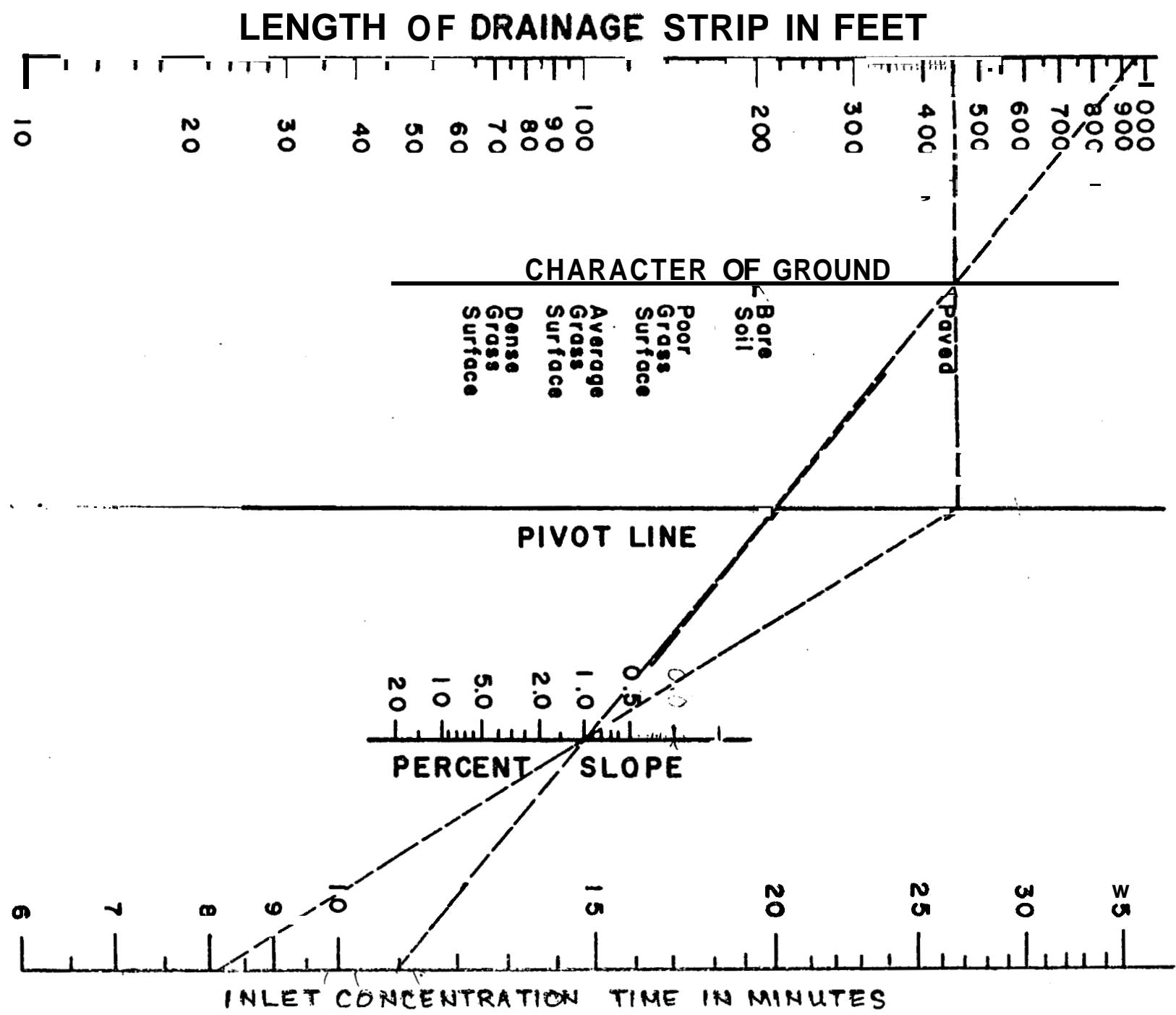
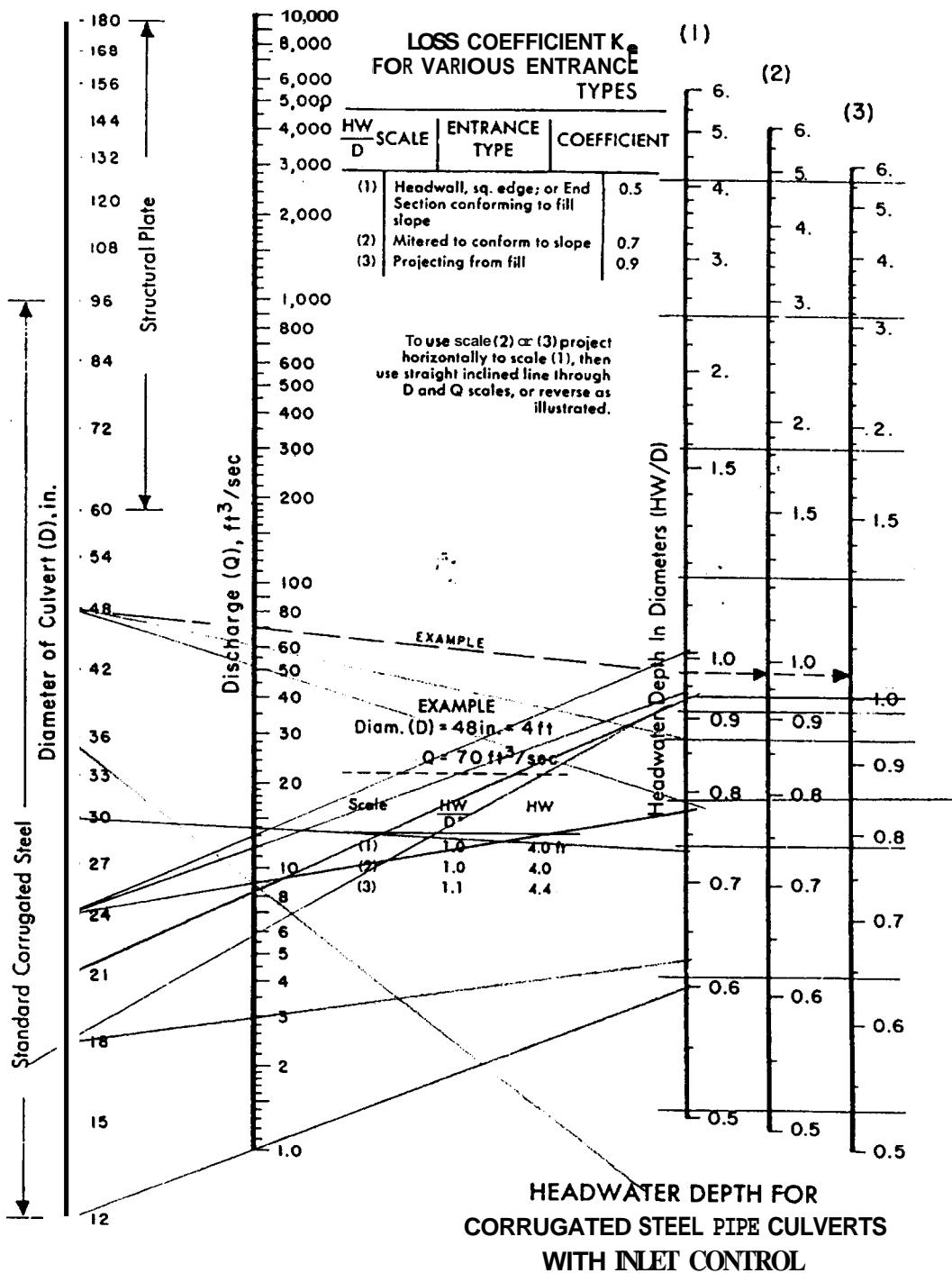


FIGURE III

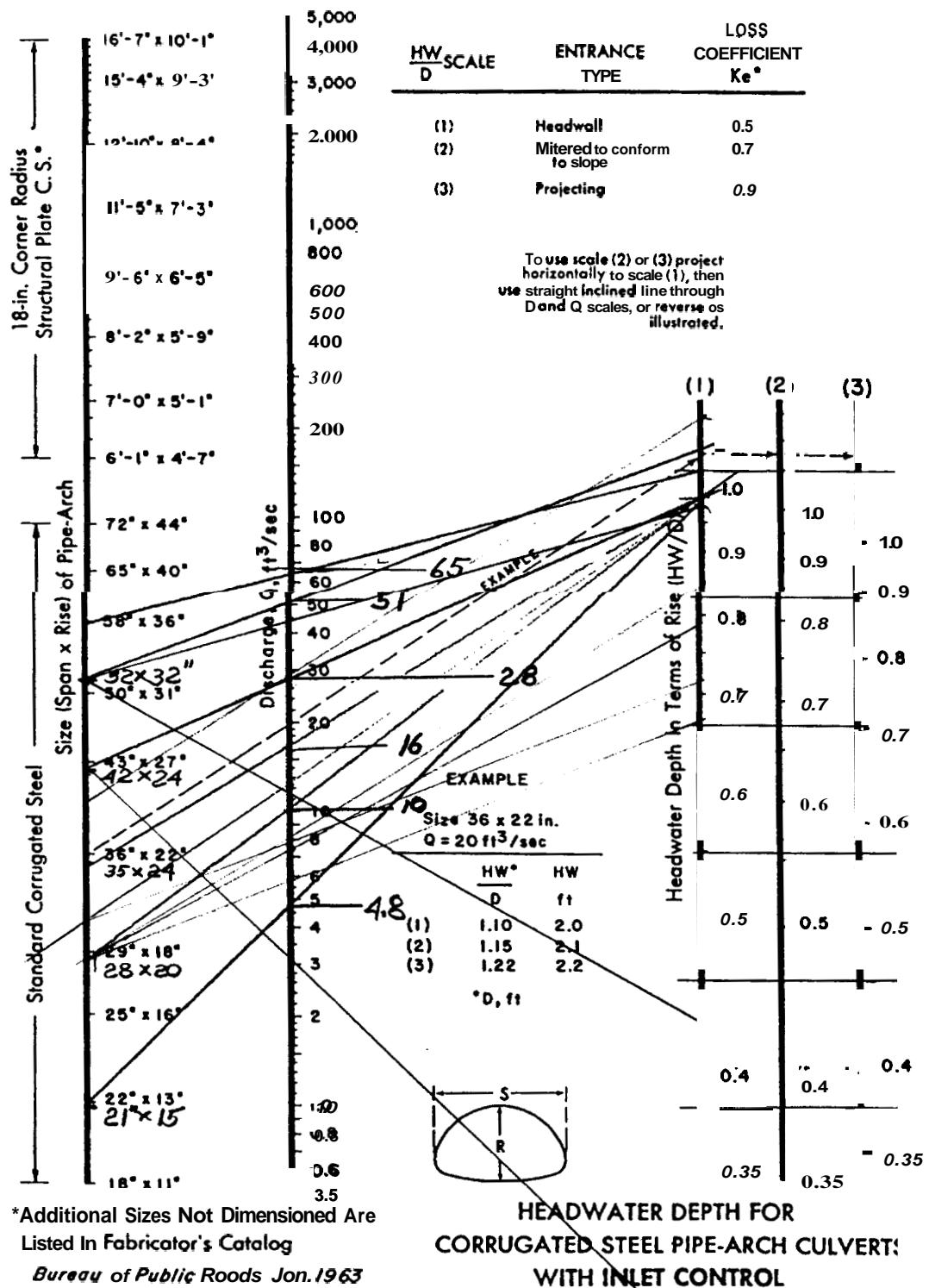
OVERLAND
FLOW - 27





FHWA HEC5

Figure 4-28 *Inlet control* nomograph for corrugated steel pipe culverts. The manufacturers recommended keeping $HWID$ to a maximum of 1.5 and preferably to no more than 1.0.



*Additional Sizes Not Dimensioned Are Listed In Fabricator's Catalog

Bureau of Public Roads Jan. 1963

Figure 4-30 *Inlet control* and headwater depths for corrugated steel pipe-arch culverts. Headwater depth should be kept low because pipe-arches are generally used where headroom is limited.

ATTACHMENTS

Alignment Worksheets:

Alignment 1

Alignment #1, 12" PVC Pipe @ 1.73%
Worksheet for Circular Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\tf Inter.fm2
Worksheet Alignment #1, 12' PVC Pipe @ 1.73%
Flow Element Circular Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient	0.009
Channel Slope	0.017300 ft/ft
Depth	1.00 ft
Diameter	12.00 in

Results

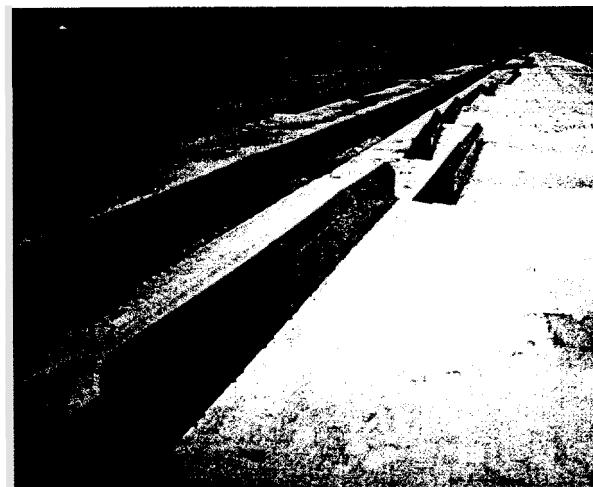
Discharge	6.77	cfs
Flow Area	0.79	ft ²
Wetted Perimeter	3.14	ft
Top Width	0.3e-7	ft
Critical Depth	0.97	ft
Percent Full	100.00	
Critical Slope	0.015266	ft/ft
Velocity	8.62	ft/s
Velocity Head	1.15	ft
Specific Energy	2.15	ft
Froude Number	0.3e-3	
Maximum Discharge	7.28	cfs
Full Flow Capacity	6.77	cfs
Full Flow Slope	0.017300	ft/ft
Flow is subcritical.		

ACO DRAIN® III

FG 200 8" Wide

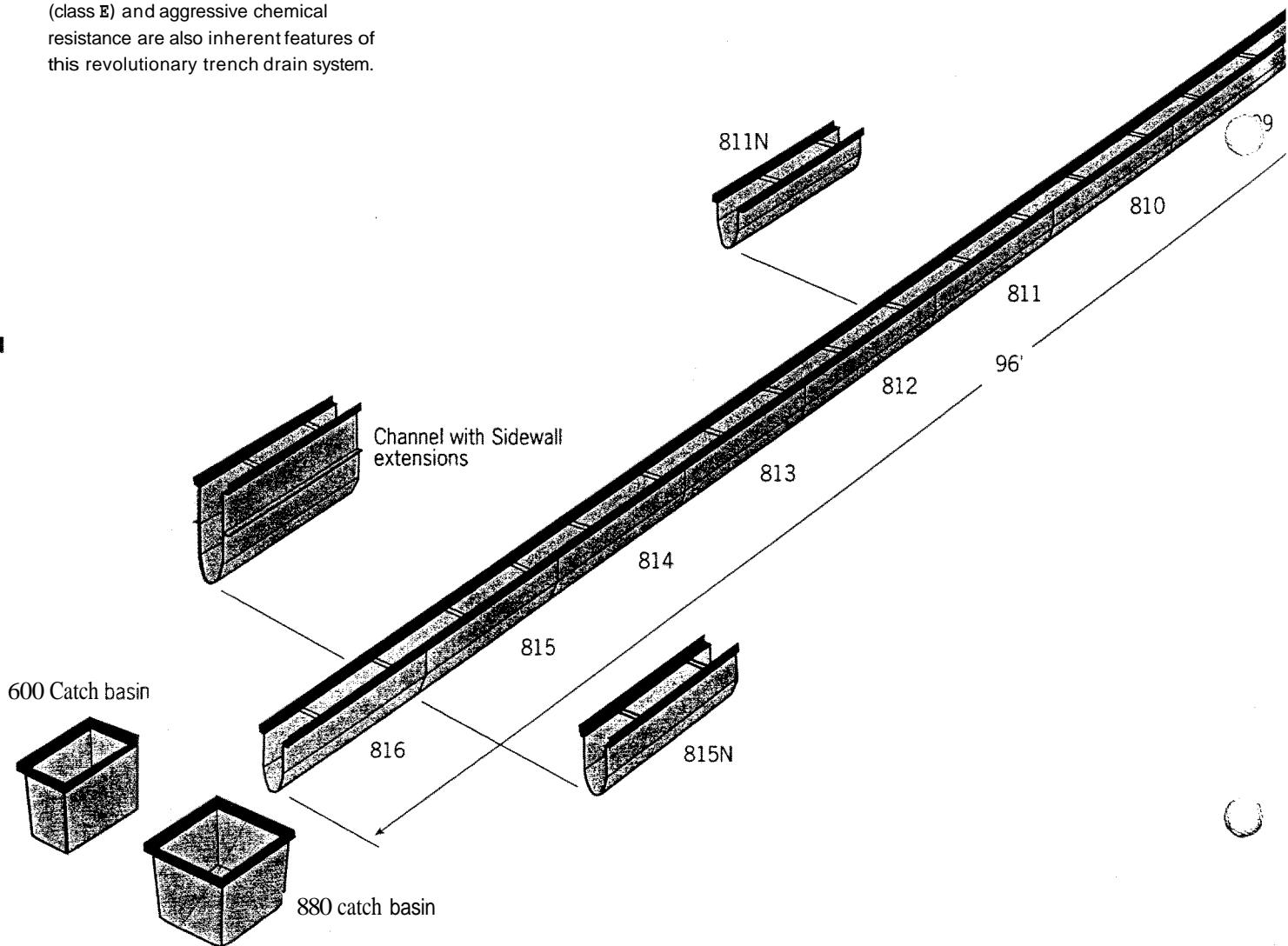
Trench Drain System

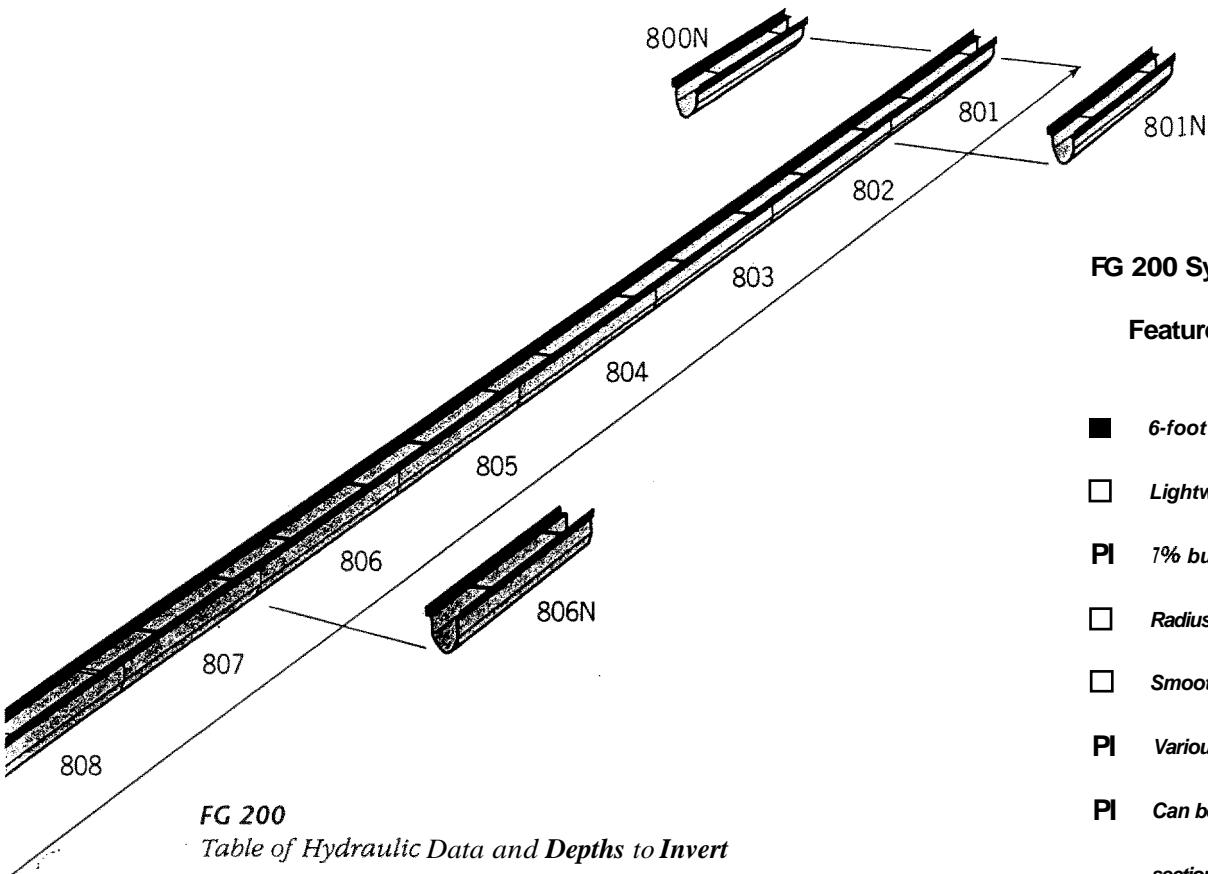
ACO FG 200, 8" wide trench drain system, is designed for applications requiring higher volumes of fluids. The FG 200 features an advanced hydraulic shape with a built-in slope of 1% and an extremely low coefficient of friction. These elements combined, provide quick and efficient surface drainage. The wide interior of the trench allows not only for increased hydraulic capacity but also for an efficient means of handling fluids. Dynamic wheel loading capabilities (class E) and aggressive chemical resistance are also inherent features of this revolutionary trench drain system.



4

III





Channel Only				Channel with Sidewall Extension		
Channel N°	Depth to invert (in)	Flow (gpm)	Flow (cfs)	Depth to Invert (in)	Flow (gpm)	Flow (cfs)
800N	5 1/2	N/A	N/A	17 1/2	N/A	N/A
801	6 1/4	381	0.85	18 1/4	2756	6.14
801N	6 1/4	N/A	N/A	18 1/4	N/A	N/A
802	7	512	1.14	19	2908	6.48
803	7 3/4	651	1.45	19 3/4	3065	6.83
804	8 1/2	790	1.76	20 1/2	3222	7.18
805	9 1/4	938	2.09	21 1/4	3375	7.52
806	10	1,082	2.41	22	3532	7.87
806N	10	N/A	N/A	22	N/A	N/A
807	10 3/4	1,230	2.74	22 3/4	3685	8.21
808	11 1/2	1,378	3.07	23 1/2	3842	8.56
809	12 1/4	1,530	3.41	24 1/4	3999	8.91
810	13	1,683	3.75	25	4156	9.26
811	13 3/4	1,836	4.09	25 3/4	4308	9.60
811N	13 3/4	N/A	N/A	25 3/4	N/A	N/A
812	14 1/2	1,988	4.43	26 1/2	4466	9.95
813	15 1/4	2,141	4.77	27 1/4	4623	10.30
814	16	2,293	5.11	28	4780	10.65
815	16 3/4	2,446	5.45	28 3/4	4937	11.00
815N	16 3/4	N/A	N/A	28 3/4	N/A	N/A
816	17 1/2	2,599	5.79	29 1/2	5094	11.35

Notes: Depths to invert are for deep end of channel; for depth at shallow end subtract $\frac{3}{4}$ " Depths assume standard $1\frac{1}{4}$ " frame for $1\frac{1}{4}$ " thick grate. Flow rates are based upon average depth of channel.

FG 200 System

Features & Benefits

- 6-foot modular channel sections**
- Lightweight channel units**
- 7% built-in slope**
- Radius bottom**
- Smooth interior surface**
- Various steel frame options**
- Can be installed in 6', 12', 18' sections**
- 2" overlap joint between channels**
- Nelson Stud welded concrete anchors**
- Heavy duty dynamic wheel loading**
- Choice of two catch basin sizes**
- Versatility of outlet locations**



Alignment 2

Alignment #2, Type 3 Ditch @ 0.2%
Worksheet for Trapezoidal Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #2, Type 3 Ditch
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.002000 ffffft
Depth	1.50 ft
Left Side Slope	2.000000 H : V
Right Side Slope	2.000000 H : V
Bottom Width	1.50 ft

Results

Discharge	30.29	cfs
Flow Area	6.75	ft ²
Wetted Perimeter	8.21	ft
Top Width	7.50	ft
Critical Depth	1.38	ft
Critical Slope	0.002944	ft/ft
Velocity	4.49	ft/s
Velocity Head	0.31	ft
Specific Energy	1.81	ft
Froude Number	0.83	
Flow is subcritical.		

Alignment #2, 28" x 20' CMPA @ 0.29%
Worksheet for Circular Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet Alignment #2, 28' x 20' CMPA @ 0.29%
Flow Element Circular Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient	0.024
Channel Slope	0.002900 ft/ft
Depth	2.00 ft
Diameter	24.00 in

Results

Discharge	6.60	cfs
Flow Area	3.14	ft ²
Wetted Perimeter	6.28	ft
Top Width	0.6e-7	ft
Critical Depth	0.91	ft
Percent Full	100.00	
Critical Slope	0.016054	ft/ft
Velocity	2.10	ft/s
Velocity Head	0.07	ft
Specific Energy	2.07	ft
Froude Number	0.51e-4	
Maximum Discharge	7.10	cfs
Full Flow Capacity	6.60	cfs
Full Flow Slope	0.002900	ft/ft
Flow is subcritical.		

Alignment #2, Type 3 Ditch @ 0.3%
Worksheet for Trapezoidal Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet Alignment #2, Type 3 Ditch @ 0.3%
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.003000 ft/ft
Depth	1.50 ft
Left Side Slope	2.000000 H : V
Right Side Slope	2.000000 H : V
Bottom Width	1.50 ft

Results

Discharge	37.09	cfs
Flow Area	6.75	ft ²
Wetted Perimeter	8.21	ft
Top Width	7.50	ft
Critical Depth	1.52	ft
Critical Slope	0.002869 ft/ft	
Velocity	5.50	ft/s
Velocity Head	0.47	ft
Specific Energy	1.97	ft
Froude Number	1.02	

Flow is supercritical.

Alignment #2, Arch Pipe 2 @ 0.5%
Worksheet for Circular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #2, Arch Pipe 2 @ 0.5%
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.024
Channel Slope	0.005000 ft/ft
Depth	2.00 ft
Diameter	24.00 in

Results

Discharge	8.66 cfs
Flow Area	3.14 ft ²
Wetted Perimeter	6.28 ft
Top Width	0.6e-7 ft
Critical Depth	1.05 ft
Percent Full	100.00
Critical Slope	0.016988 fVft
Velocity	2.76 ft/s
Velocity Head	0.12 ft
Specific Energy	2.12 ft
Froude Number	0.67e-4
Maximum Discharge	9.32 cfs
Full Flow Capacity	8.66 cfs
Full Flow Slope	0.005000 ft/ft
Flow is subcritical.	

Alignment #2, Type 3 Ditch @ 0.47%
Worksheet for Trapezoidal Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #2, Type 3 Ditch @ 0.47%
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.004700 ft/ft
Depth	1.50 ft
Left Side Slope	2.000000 H : V
Right Side Slope	2.000000 H : V
Bottom Width	1.50 ft

Results

Discharge	46.43	cfs
Flow Area	6.75	ft ²
Wetted Perimeter	8.21	ft
Top Width	7.50	ft
Critical Depth	1.68	ft
Critical Slope	0.002789 ft/ft	
Velocity	6.88	ft/s
Velocity Head	0.74	ft
Specific Energy	2.24	ft
Froude Number	1.28	

Flow is supercritical.

Alignment #2, 28" x 20" CMPA @ 0.57%
Worksheet for Circular Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\11inter.fm2
Worksheet Alignment #2, Arch Pipe 3 @ 0.57%
Flow Element Circular Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient 0.024
Channel Slope 0.005700 ft/ft
Depth 2.00 ft
Diameter 24.00 in

Results

Discharge 9.25 cfs
Flow Area 3.14 ft²
Wetted Perimeter 6.28 ft
Top Width 0.6e-7 ft
Critical Depth 1.09 ft
Percent Full 100.00
Critical Slope 0.017298 ft/ft
Velocity 2.94 ft/s
Velocity Head 0.13 ft
Specific Energy 2.13 ft
Froude Number 0.72e-4
Maximum Discharge 9.95 cfs
Full Flow Capacity 9.25 cfs
Full Flow Slope 0.005700 ft/ft
Flow is subcritical.

Alignment #2, Type 3 Ditch @ 0.86%
Worksheet for Trapezoidal Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet Alignment #2, Type 3 Ditch @ 0.86%
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient 0.013
Channel Slope 0.008600 ft/ft
Depth 1.50 ft
Left Side Slope 2.000000 H : V
Right Side Slope 2.000000 H : V
Bottom Width 1.50 ft

Results

Discharge 62.80 cfs
Flow Area 6.75 ft²
Wetted Perimeter 8.21 ft
Top Width 7.50 ft
Critical Depth 1.94 ft
Critical Slope 0.002684 ft/ft
Velocity 9.30 ft/s
Velocity Head 1.35 ft
Specific Energy 2.85 ft
Froude Number 1.73
Flow is supercritical.

Alignment #2, Existing 24" CMP @ 1.45%
Worksheet for Circular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #2, Existing 24' CMP @ 1.45%
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.024
Channel Slope	0.014500 ft/ft
Depth	2.00 ft
Diameter	24.00 in

Results

Discharge	14.75 cfs
Flow Area	3.14 ft²
Wetted Perimeter	6.28 ft
Top Width	0.6e-7 ft
Critical Depth	1.38 ft
Percent Full	100.00
Critical Slope	0.021303 ft/ft
Velocity	4.70 ft/s
Velocity Head	0.34 ft
Specific Energy	2.34 ft
Froude Number	0.11e-3
Maximum Discharge	15.87 cfs
Full Flow Capacity	14.75 cfs
Full Flow Slope	0.014500 ft/ft
Flow is subcritical.	

Alignment #2, Type 3 Ditch @ 0.57%
Worksheet for Trapezoidal Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\ff inter.fm2
Worksheet	Alignment #2, Type 3 Ditch @ 0.57%
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.005700 ft/ft
Depth	1.50 ft
Left Side Slope	2.000000 H : V
Right Side Slope	2.000000 H : V
Bottom Width	1.50 ft

Results

Discharge	51.13	cfs
Flow Area	6.75	ft ²
Wetted Perimeter	8.21	ft
Top Width	7.50	ft
Critical Depth	1.76	ft
Critical Slope	0.002755	ft/ft
Velocity	7.57	ft/s
Velocity Head	0.89	ft
Specific Energy	2.39	ft
Froude Number	1.41	

Flow is supercritical.

Alignment #2, 24" CMP @ 0.67%
Worksheet for Circular Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet Alignment #2, 24' CMP @ 0.67%
Flow Element Circular Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient 0.024
Channel Slope 0.006700 ft/ft
Depth 2.00 ft
Diameter 24.00 in

Results

Discharge 10.03 cfs
Flow Area 3.14 ft²
Wetted Perimeter 6.28 ft
Top Width 0.6e-7 ft
Critical Depth 1.13 ft
Percent Full 100.00
Critical Slope 0.017741 ft/ft
Velocity 3.19 ft/s
Velocity Head 0.16 ft
Specific Energy 2.16 ft
Froude Number 0.78e-4
Maximum Discharge 10.79 cfs
Full Flow Capacity 10.03 cfs
Full Flow Slope 0.006700 ft/ft
Flow is subcritical.

**Alignment #2, Type 3 Ditch @ 0.68%
Worksheet for Trapezoidal Channel**

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #2, Type 3 Ditch @ 0.68%
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.006800 ft/ft
Depth	1.50 ft
Left Side Slope	2.000000 H :V
Right Side Slope	2.000000 H :V
Bottom Width	1.50 ft

Results

Discharge	55.84	cfs
Flow Area	6.75	ft ²
Wetted Perimeter	8.21	ft
Top Width	7.50	ft
Critical Depth	1.84	ft
Critical Slope	0.002724	ft/ft
Velocity	8.27	ft/s
Velocity Head	1.06	ft
Specific Energy	2.56	ft
Froude Number	1.54	
Flow is supercritical.		

Alignment #2, Existing 36" CMP @ 0.34%
Worksheet for Circular Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet Alignment Y2, Existing 36' CMP @ 0.34%
Flow Element Circular Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient 0.024
Channel Slope 0.003400 ft/ft
Depth 3.00 ft
Diameter 36.00 in

Results

Discharge 21.07 cfs
Flow Area 7.07 ft²
Wetted Perimeter 9.42 ft
Top Width 0.73e-7 ft
Critical Depth 1.47 ft
Percent Full 100.00
Critical Slope 0.014410 ft/ft
Velocity 2.98 ft/s
Velocity Head 0.14 ft
Specific Energy 3.14 ft
Froude Number 0.53e-4
Maximum Discharge 22.66 cfs
Full Flow Capacity 21.07 cfs
Full Flow Slope 0.003400 ft/ft
Flow is subcritical.

Alignment #2, Type 3 Ditch @ 3.88%
Worksheet for Trapezoidal Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #2, Type 3 Ditch @ 3.88%
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.038800 ft/ft
Depth	1.50 ft
Left Side Slope	2.000000 H : V
Right Side Slope	2.000000 H : V
Bottom Width	5.00 ft

Results

Discharge	274.65	cfs
Flow Area	12.00	ft ²
Wetted Perimeter	11.71	ft
Top Width	11.00	ft
Critical Depth	3.08	ft
Critical Slope	0.002182 ft/ft	
Velocity	22.89	ft/s
Velocity Head	8.14	ft
Specific Energy	9.64	ft
Froude Number	3.86	

Flow is supercritical.

Alignment 3

Alignment #3, Type 1 Ditch @ 0.2%
Worksheet for Triangular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tr intec.fm2
Worksheet	Alignment #3
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.002000 ft/ft
Depth	0.50 ft
Left Side Slope	5.000000 H : V
Right Side Slope	5.000000 H : V

Results

Discharge	2.50	cfs
Flow Area	1.25	ft ²
Wetted Perimeter	5.10	ft--
Top Width	5.00	ft
Critical Depth	0.43	ft
Critical Slope	0.004203	ft/ft
Velocity	2.00	ft/s
Velocity Head	0.06	ft
Specific Energy	0.56	ft
Froude Number	0.71	

Flow is subcritical.

Alignment #3, 12" CMP @ 0.67%
Worksheet for Circular Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\ff inter.fm2
Worksheet Alignment #3, 12' CMP @ 0.67%
Flow Element Circular Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient 0.024
Channel Slope 0.006700 ft/ft
Depth 1.00 ft
Diameter 12.00 in

Results

Discharge 1.58 cfs
Flow Area 0.79 ft²
Wetted Perimeter 3.14 ft
Top Width 0.3e-7 ft
Critical Depth 0.53 ft
Percent Full 100.00
Critical Slope 0.021580 ft/ft
Velocity 2.01 ft/s
Velocity Head 0.06 ft
Specific Energy 1.06 ft
Froude Number 0.69e-4
Maximum Discharge 1.70 cfs
Full Flow Capacity 1.58 cfs
Full Flow Slope 0.006700 ft/ft
Flow is subcritical.

Alignment 4

Alignment #4, Type 1 Ditch @ 0.57%
Worksheet for Triangular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #4, Type 1 Ditch @ 0.57%
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.005700 ft/ft
Depth	0.50 ft
Left Side Slope	5.000000 H : V
Right Side Slope	5.000000 H : V

Results

Discharge	4.23	cfs
Flow Area	1.25	ft ²
Wetted Perimeter	5.10	ft
Top Width	5.00	ft
Critical Depth	0.54	ft
Critical Slope	0.003920	ft/ft
Velocity	3.38	ft/s
Velocity Head	0.18	ft
Specific Energy	0.68	ft
Froude Number	1.19	
Flow is supercritical.		

Alignment #4, Type 1 Ditch @ 2.98%
Worksheet for Triangular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\if inter.fm2
Worksheet	Alignment #4, Type 1 Ditch @ 2.98%
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Discharge

Inout Data

Mannings Coefficient	0.013
Channel Slope	0.029800 ft/ft
Depth	0.50 ft
Left Side Slope	5.000000 H : V
Right Side Slope	5.000000 H : V

Results

Discharge	9.66	cfs
Flow Area	1.25	ft ²
Wetted Perimeter	5.10	ft
Top Width	5.00	ft
Critical Depth	0.75	ft
Critical Slope	0.003511	ft/ft
Velocity	7.73	ft/s
Velocity Head	0.93	ft
Specific Energy	1.43	ft
Froude Number	2.73	

Flow is supercritical.

Alignment #4 Type 1 Ditch @ 0.4% Worksheet for Triangular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #4, Type 1 Ditch @ 0.4%
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.004000 ft/ft
Depth	0.50 ft
Left Side Slope	5.000000H : V
Right Side Slope	5.000000H : V

Results

Discharge	3.54	cfs
Flow Area	1.25	ft ²
Wetted Perimeter	5.10	ft
Top Width	5.00	ft
Critical Depth	0.50	ft
Critical Slope	0.004013	ft/ft
Velocity	2.83	ft/s
Velocity Head	0.12	ft
Specific Energy	0.62	ft
Froude Number	1.00	

Flow is subcritical.

Alignment #4, Type 2 Ditch @ 0.4%
Worksheet for Triangular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\if inter.fm2
Worksheet	Alignment #4, Type 2 Ditch @ 0.4%
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.004000 ft/ft
Depth	0.63 ft
Left Side Slope	4.800000 H : V
Right Side Slope	4.800000 H : V

Results

Discharge	6.15	cfs
Flow Area	1.87	ft ²
Wetted Perimeter	6.13	ft
Top Width	6.00	ft
Critical Depth	0.63	ft
Critical Slope	0.003716	ft/ft
Velocity	3.28	ft/s
Velocity Head	0.17	ft
Specific Energy	0.79	ft
Froude Number	1.04	

Flow is supercritical.

Alignment #4, Type 3 Ditch @ 0.2% Worksheet for Trapezoidal Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet Alignment #4, Type 3 Ditch @ 0.2%
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient 0.013
Channel Slope 0.002000 ft/ft
Depth **1.50** ft
Left Side Slope 2.000000 H : V
Right Side Slope 2.000000 H : V
Bottom Width **1.50** ft

Results

Discharge 30.29 cfs
Flow Area **6.75** ft²
Wetted Perimeter 8.21 ft
Top Width **7.50** ft
Critical Depth 1.38 ft
Critical Slope 0.002944 ft/ft
Velocity 4.49 ft/s
Velocity Head 0.31 ft
Specific Energy 1.81 ft
Froude Number 0.83
Flow is subcritical.

Alignment #4, 24' CMP @ 0.91%
Worksheet for Circular Channel

Project Description

Project File	c:\job files\intec\Interim action ph. 1\tf inter.fm2
Worksheet	Alignment #4, 24' CMP @ 0.91%
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Inout Data

Mannings Coefficient	0.024
Channel Slope	0.009100 ft/ft
Depth	2.00 ft
Diameter	24.00 in

Results

Discharge	11.69 cfs
Flow Area	3.14 ft ²
Wetted Perimeter	6.28 ft
Top Width	0.6e-7 ft
Critical Depth	1.23 ft
Percent Full	100.00
Critical Slope	0.018811 ffffft
Velocity	3.72 ft/s
Velocity Head	0.22 ft
Specific Energy	2.22 ft
Froude Number	0.9e-4
Maximum Discharge	12.57 cfs
Full Flow Capacity	11.69 cfs
Full Flow Slope	0.009100 ft/ft
Flow is subcritical.	

Alignment #4, Type 3 Ditch @ 0.22%
Worksheet for Trapezoidal Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\if Inter.fm2
Worksheet Alignment #4, Type 3 Ditch @ 0.22%
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient 0.013
Channel Slope 0.002200 ft/ft
Depth **1.50** ft
Left Side Slope 2.000000 H :V
Right Side Slope 2.000000 H :V
Bottom Width **1.50** ft

Results

Discharge **31.76** cfs
Flow Area **6.75** ft²
Wetted Perimeter 8.21 ft
Top Width **7.50** ft
Critical Depth 1.41 ft
Critical Slope 0.002926 ft/ft
Velocity **4.71** ft/s
Velocity Head **0.34** ft
Specific Energy **1.84** ft
Froude Number **0.87**
Flow is subcritical.

**Alignment #4, 24' CMP @ 1.0%
Worksheet for Circular Channel**

Project Description

Project File	c:\job files\intec\interim action ph. 1\if inter.fm2
Worksheet	Alignment #4, 24' CMP @ 1.0%
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.024
Channel Slope	0.01 0000 ft/ft
Depth	2.00 ft
Diameter	24.00 in

Results

Discharge	12.25 cfs
Flow Area	3.14 ft ²
Wetted Perimeter	6.28 ft
Top Width	0.6e-7 ft
Critical Depth	1.26 ft
Percent Full	100.00
Critical Slope	0.019217 ft/ft
Velocity	3.90 ft/s
Velocity Head	0.24 ft
Specific Energy	2.24 ft
Froude Number	0.95e-4
Maximum Discharge	13.18 cfs
Full Flow Capacity	12.25 cfs
Full Flow Slope	0.010000 ft/ft

Flow is subcritical.

Rectangular Conc. Structure @ 3.1%
Worksheet for Rectangular Channel

Project Description

Project File c:\Job files\intec\interim action ph. 1\tf inter.fm2
Worksheet Alignment #4, Rectangular Conc Struct
Flow Element Rectangular Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.031400 ft/ft
Depth	1.50 ft
Bottom Width	6.00 ft

Results

Discharge	182.29	cfs
Flow Area	9.00	ft ²
Wetted Perimeter	9.00	ft
Top Width	6.00	ft
Critical Depth	3.06	ft
Critical Slope	0.004332	ft/ft
Velocity	20.25	ft/s
Velocity Head	6.38	ft
Specific Energy	7.88	ft
Froude Number	2.92	
Flow is supercritical.		

Alignment #4, Existing 24" CMP @ 1.05%
Worksheet for Circular Channel

Project Description

Project File	c:\job files\intec\Interim action ph. 111inter.fm2
Worksheet	Alignment #4, Existing 24" CMP @ 1.05%
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.024
Channel Slope	0.010500 ft/ft
Depth	2.00 ft
Diameter	24.00 in

Results

Discharge	12.56 cfs
Fflow Area	3.14 ft ²
Wetted Perimeter	6.28 ft
Top Width	0.6e-7 ft
Critical Depth	1.27 ft
Percent Full	100.00
Critical Slope	0.019444 ft/ft
Velocity	4.00 ft/s
Velocity Head	0.25 ft
Specific Energy	2.25 ft
Froude Number	0.97e-4
Maximum Discharge	13.51 cfs
Full Flow Capacity	12.56 cfs
Full Flow Slope	0.010500 ft/ft
Flow is subcritical.	

Alignment #4, Type 3 Ditch @ 0.21%
Worksheet for Trapezoidal Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #4, Type 3 Ditch @ 0.21%
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.002100 ft/ft
Depth	1.50 ft
Left Side Slope	2.000000 H : V
Right Side Slope	2.000000 H : V
Bottom Width	1.50 ft

Results

Discharge	31.03	cfs
Flow Area	6.75	ft ²
Wetted Perimeter	8.21	ft
Top Width	7.50	ft
Critical Depth	1.39	ft
Critical Slope	0.002935	fffft
Velocity	4.60	ft/s
Velocity Head	0.33	ft
Specific Energy	1.83	ft
Froude Number	0.85	

Flow is subcritical.

Alignment #4, 30" CMP @ 0.34%
Worksheet for Circular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #4, 30' CMP @ 0.34%
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.024
Channel Slope	0.003400 ft/ft
Depth	2.50 ft
Diameter	30.00 in

Results

Discharge	12.95 cfs
Flow Area	4.91 ft ²
Wetted Perimeter	7.85 ft
Top Width	0.67e-7 ft
Critical Depth	1.21 ft
Percent Full	100.00
Critical Slope	0.015218 ft/ft
Velocity	2.64 ffps
Velocity Head	0.11 ft
Specific Energy	2.61 ft
Froude Number	0.54e-4
Maximum Discharge	13.93 cfs
Full Flow Capacity	12.95 cfs
Full Flow Slope	0.003400 ft/ft

Flow is subcritical.

Alignment #4, Type 3 Ditch @ 0.22%
Worksheet for Trapezoidal Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\11inter.fm2
Worksheet Alignment #4, Type 3 Ditch @ 0.22%
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient 0.013
Channel Slope 0.002200 ft/ft
Depth 1.50 ft
Left Side Slope 2.000000 H : V
Right Side Slope 2.000000 H : V
Bottom Width 1.50 ft

Results

Discharge 31.76 cfs
Flow Area 6.75 ft²
Wetted Perimeter 8.21 ft
Top Width 7.50 ft
Critical Depth 1.41 ft
Critical Slope 0.002926 1/11
Velocity 4.71 ft/s
Velocity Head 0.34 ft
Specific Energy 1.84 ft
Froude Number 0.87

Flow is subcritical.

Alignment #4, Type 3 Ditch @ 1.59%
Worksheet for Trapezoidal Channel

Project Description

Project File	c:\job files\intec\Interim action ph. 1\tf inter.fm2
Worksheet	Alignment #4, Type 3 Ditch @ 1.59%
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.015900 ft/ft
Depth	1.50 ft
Left Side Slope	2.000000 H : V
Right Side Slope	2.000000 H : V
Bottom Width	1.50 ft

Results

Discharge	85.39	cfs
Flow Area	6.75	ft ²
Wetted Perimeter	8.21	ft
Top Width	7.50	ft
Critical Depth	2.23	ft
Critical Slope	0.002581	ft/ft
Velocity	12.65	ft/s
Velocity Head	2.49	ft
Specific Energy	3.99	ft
Froude Number	2.35	

Flow is supercritical.

Alignment #4, Exist 40"x28" CMPA @ 1.01%
Worksheet for Circular Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet Alignment #4, Exist 40"x28" CMPA @ 1.01%
Flow Element Circular Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient	0.024
Channel Slope	0.010100 fffff
Depth	3.00 ft
Diameter	36.00 in

Results

Discharge	36.31	cfs
Flow Area	7.07	ft ²
Wetted Perimeter	9.42	ft
Top Width	0.73e-7	ft
Critical Depth	1.96	ft
Percent Full	100.00	
Critical Slope	0.017409	ft/ft
Velocity	5.14	ft/s
Velocity Head	0.41	ft
Specific Energy	3.41	ft
Froude Number	0.92e-4	
Maximum Discharge	39.06	cfs
Full Flow Capacity	36.31	cfs
Full Flow Slope	0.01 0100	ft/ft

Flow is subcritical.

Alignment 5

Alignment #5, Type 1 Ditch @ 1.19%
Worksheet for Triangular Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet Alignment #5, Type 1 Ditch @ 1.19%
Flow Element Triangular Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient 0.013
Channel Slope 0.011900 ft/ft
Depth 0.50 ft
Left Side Slope 5.000000 H : V
Right Side Slope 5.000000 H : V

Results

Discharge 6.10 cfs
Flow Area 1.25 ft²
Wetted Perimeter 5.10 ft
Top Width 5.00 ft
Critical Depth 0.62 ft
Critical Slope 0.003732 ft/ft
Velocity 4.88 ft/s
Velocity Head 0.37 ft
Specific Energy 0.87 ft
Froude Number 1.72
Flow is supercritical.

Alignment #5, Type 1 Ditch @ 7.02%
Worksheet for Triangular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf Inter.fm2
Worksheet	Alignment #5, Type 1 Ditch @ 7.02%
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.070200 ft/ft
Depth	0.50 ft
Left Side Slope	5.000000 H : V
Right Side Slope	5.000000 H : V

Results

Discharge	14.83	cfs
Flow Area	1.25	ft ²
Wetted Perimeter	5.10	ft
Top Width	5.00	ft
Critical Depth	0.89	ft
Critical Slope	0.003316	ft/ft
Velocity	11.86	ft/s
Velocity Head	2.19	ft
Specific Energy	2.69	ft
Froude Number	4.18	

Flow is supercritical.

Alignment #5, Existing 18' CMP @ 1.28%
Worksheet for Circular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #5, Existing 18' CMP @ 1.28%
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.024
Channel Slope	0.012800 ft/ft
Depth	1.50 ft
Diameter	18.00 in

Results

Discharge	6.44	cfs
Flow Area	1.77	ft ²
Wetted Perimeter	4.71	ft
Top Width	0.37e-7	ft
Critical Depth	0.98	ft
Percent Full	100.00	
Critical Slope	0.021969	ft/ft
Velocity	3.64	ft/s
Velocity Head	0.21	ft
Specific Energy	1.71	ft
Froude Number	0.92e-4	
Maximum Discharge	6.92	cfs
Full Flow Capacity	6.44	cfs
Full Flow Slope	0.012800	ft/ft
Flow is subcritical.		

Alignment #5, Type 3 Ditch @ 7.23% Worksheet for Trapezoidal Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\11inter.fm2
Worksheet	Alignment #5, Type 3 Ditch @ 7.23%
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.072300 ft/ft
Depth	1.50 ft
Left Side Slope	2.000000 H : V
Right Side Slope	2.000000 H : V
Bottom Width	1.50 ft

Results

Discharge	182.09	cfs
Flow Area	6.75	ft ²
Wetted Perimeter	8.21	ft
Top Width	7.50	ft
Critical Depth	3.14	ft
Critical Slope	0.002342 ft/ft	
Velocity	26.98	ft/s
Velocity Head	11.31	ft
Specific Energy	12.81	ft
Froude Number	5.01	
Flow is supercritical.		

Alignment 6

Alignment #6, Type 1 Ditch @ 0.53%
Worksheet for Triangular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #6, Type 1 Ditch @ 0.53%
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.005300 ft/ft
Depth	0.50 ft
Left Side Slope	5.000000 H : V
Right Side Slope	5.000000 H : V

Results

Discharge	4.07	cfs
Flow Area	1.25	ft ²
Wetted Perimeter	5.10	ft
Top Width	5.00	ft
Critical Depth	0.53	ft
Critical Slope	0.003939	ft/ft
Velocity	3.26	ft/s
Velocity Head	0.17	ft
Specific Energy	0.67	ft
Froude Number	1.15	
Flow is supercritical.		

Alignment #6, Type 1 Ditch @ 0.83% Worksheet for Triangular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #6, Type 1 Ditch @ 0.83%
Flow Element	Triangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.008300 ft/ft
Depth	0.50 ft
Left Side Slope	5.000000 H : V
Right Side Slope	5.000000 H : V

Results

Discharge	5.10	cfs
Flow Area	1.25	ft ²
Wetted Perimeter	5.10	ft
Top Width	5.00	ft
Critical Depth	0.58	ft
Critical Slope	0.003823 ft/ft	
Velocity	4.08	ft/s
Velocity Head	0.26	ft
Specific Energy	0.76	ft
Froude Number	1.44	
Flow is supercritical.		

Alignment #6, Type 1 Ditch @ 0.68%
Worksheet for Triangular Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet Alignment #6, Type 1 Ditch @ 0.68%
Flow Element Triangular Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.006800 ft/ft
Depth	0.50 ft
Left Side Slope	5.000000 H : V
Right Side Slope	5.000000 H : V

Results

Discharge	4.61	cfs
Flow Area	1.25	ft ²
Wetted Perimeter	5.10	ft
Top Width	5.00	ft
Critical Depth	0.56	ft
Critical Slope	0.003874	ft/ft
Velocity	3.69	ft/s
Velocity Head	0.21	ft
Specific Energy	0.71	ft
Froude Number	1.30	

Flow is supercritical.

Alignment #6, 18' CMP @ 0.5%
Worksheet for Circular Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet Alignment #6, 18' CMP @ 0.5%
Flow Element Circular Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient 0.024
Channel Slope 0.005000 ft/ft
Depth 1.50 ft
Diameter 18.00 in

Results

Discharge 4.02 cfs
Flow Area 1.77 ft²
Wetted Perimeter 4.71 ft
Top Width 0.37e-7 ft
Critical Depth 0.77 ft
Percent Full 100.00
Critical Slope 0.018473 ft/ft
Velocity 2.28 ft/s
Velocity Head 0.08 ft
Specific Energy 1.58 ft
Froude Number 0.58e-4
Maximum Discharge 4.33 cfs
Full Flow Capacity 4.02 cfs
Full Flow Slope 0.005000 ft/ft
Flow is subcritical.

Alignment 7

Alignment #7, Type 1 Ditch @ 0.2%
Worksheet for Triangular Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet Alignment #7, Type 1 Ditch @ 0.2%
Flow Element Triangular Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient 0.013
Channel Slope 0.002000 fVft
Depth 0.50 ft
Left Side Slope 5.000000 H : V
Right Side Slope 5.000000 H : V

Results

Discharge 2.50 cfs
Flow Area 1.25 ft²
Wetted Perimeter 5.10 ft
Top Width 5.00 ft
Critical Depth 0.43 ft
Critical Slope 0.004203 ft/ft
Velocity 2.00 ft/s
Velocity Head 0.06 ft
Specific Energy 0.56 ft
Froude Number 0.71
Flow is subcritical.

Alignment 8

Alignment #8, Type 3 Ditch @ 2.68% Worksheet for Trapezoidal Channel

Project Description

Project File c:\job files\intec\interim action ph. 1\11inter.fm2
Worksheet Alignment #8, Type 3 Ditch @ 2.68%
Flow Element Trapezoidal Channel
Method Manning's Formula
Solve For Discharge

Input Data

Mannings Coefficient 0.013
Channel Slope 0.026800 ft/ft
Depth 1.50 ft
Left Side Slope 2.000000 H : V
Right Side Slope 2.000000 H : V
Bottom Width 1.50 ft

Results

Discharge 110.86 cfs
Flow Area 6.75 ft²
Wetted Perimeter 8.21 ft
Top Width 7.50 ft
Critical Depth 2.51 ft
Critical Slope 0.002496 ft/ft
Velocity 16.42 ft/s
Velocity Head 4.19 ft
Specific Energy 5.69 ft
Froude Number 3.05
Flow is supercritical.

Alignment #8, Exist 42"x30" CMPA @ 0.82%
Worksheet for Circular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #8, Exist 42"x30" CMPA @ 0.82%
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.024
Channel Slope	0.008200 ft/ft
Depth	3.00 ft
Diameter	36.00 in

Results

Discharge	32.71 cfs
Flow Area	7.07 ft ²
Wetted Perimeter	9.42 ft
Top Width	0.73e-7 ft
Critical Depth	1.86 ft
Percent Full	100.00
Critical Slope	0.016546 ft/ft
Velocity	4.63 ft/s
Velocity Head	0.33 ft
Specific Energy	3.33 ft
Froude Number	0.83e-4
Maximum Discharge	35.19 cfs
Full Flow Capacity	32.71 cfs
Full Flow Slope	0.008200 ft/ft
Flow is subcritical.	

Alignment #8, Type 3 Ditch @ 0.20%
Worksheet for Trapezoidal Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #8, Type 3 Ditch @ 0.20%
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.013
Channel Slope	0.002000 ft/ft
Depth	1.50 ft
Left Side Slope	2.000000 H : V
Right Side Slope	2.000000 H : V
Bottom Width	1.50 ft

Results

Discharge	30.29	cfs
Flow Area	6.75	ft ²
Wetted Perimeter	8.21	ft
Top Width	7.50	ft
Critical Depth	1.38	ft
Critical Slope	0.002944 ft/ft	
Velocity	4.49	ft/s
Velocity Head	0.31	ft
Specific Energy	1.81	ft
Froude Number	0.83	
Flow is subcritical.		

Alignment #8, 52"x32" CMPA @ 0.40%
Worksheet for Circular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #8, 52"x32" CMPA @ 0.40%
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.024
Channel Slope	0.004000 ft/ft
Depth	3.67 ft
Diameter	44.00 in

Results

Discharge	39.02	cfs
Flow Area	10.56	ft ²
Wetted Perimeter	11.52	ft
Top Width	0.00	ft
Critical Depth	1.91	ft
Percent Full	100.00	
Critical Slope	0.013842	ft/ft
Velocity	3.70	ft/s
Velocity Head	0.21	ft
Specific Energy	FULL	ft
Froude Number	FULL	
Maximum Discharge	41.97	cfs
Full Flow Capacity	39.02	cfs
Full Flow Slope	0.004000	ft/ft

Alignment #8, Exist 52"x32" CMPA @ 1.99%
Worksheet for Circular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #8, Exist 52"x32" CMPA @ 1.99%
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.024
Channel Slope	0.019900 ft/ft
Depth	3.67 ft
Diameter	44.00 in

Results

Discharge	87.03 cfs
Flow Area	10.56 ft ²
Wetted Perimeter	11.52 ft
Top Width	0.00 ft
Critical Depth	2.88 ft
Percent Full	100.00
Critical Slope	0.021551 ft/ft
Velocity	8.24 ft/s
Velocity Head	1.06 ft
Specific Energy	FULL ft
Froude Number	FULL
Maximum Discharge	93.61 cfs
Full Flow Capacity	87.03 cfs
Full Flow Slope	0.019900 ft/ft

Alignment #8, Exist 58"x36" CMPA @ 0.46%
Worksheet for Circular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #8, Exist 58"x36" CMPA @ 0.46%
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.024
Channel Slope	0.004600 ffffft
Depth	4.00 ft
Diameter	48.00 in

Results

Discharge	52.77 cfs
Flow Area	12.57 ft ²
Wetted Perimeter	12.57 ft
Top Width	0.12e-6 ft
Critical Depth	2.18 ft
Percent Full	100.00
Critical Slope	0.013763 ft/ft
Velocity	4.20 ft/s
Velocity Head	0.27 ft
Specific Energy	4.27 ft
Froude Number	0.72e-4
Maximum Discharge	56.76 cfs
Full Flow Capacity	52.77 cfs
Full Flow Slope	0.004600 ffffft
Flow is subcritical.	

Alignment #8, 48' CMP @ 0.50%
Worksheet for Circular Channel

Project Description

Project File	c:\job files\intec\interim action ph. 1\tf inter.fm2
Worksheet	Alignment #8, 48' CMP @ 0.50%
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Mannings Coefficient	0.024
Channel Slope	0.005000 ft/ft
Depth	4.00 ft
Diameter	48.00 in

Results

Discharge	55.01 cfs
Flow Area	12.57 ft ²
Wetted Perimeter	12.57 ft
Top Width	0.12e-6 ft
Critical Depth	2.23 ft
Percent Full	100.00
Critical Slope	0.013940 ft/ft
Velocity	4.38 ft/s
Velocity Head	0.30 ft
Specific Energy	4.30 ft
Froude Number	0.75e-4
Maximum Discharge	59.18 cfs
Full Flow Capacity	55.01 cfs
Full Flow Slope	0.005000 ft/ft
Flow is subcritical.	
